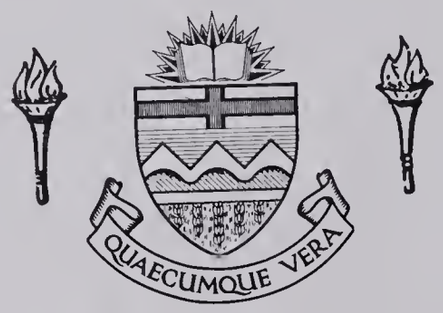

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THE UNIVERSITY OF ALBERTA

LAND USE CHANGES IN THE EASTERN IRRIGATION DISTRICT OF ALBERTA

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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ABSTRACT

The Eastern Irrigation District is an area of about 1,500,000 acres in South-eastern Alberta which was a part of the Dominion Land Grant made to the Canadian Pacific Railway Company in 1903. It was then predominantly a ranching area precariously suitable for dry-land farming. It has light annual precipitation accompanied by a relatively high evaporation but the soil is fertile and the topography is relatively favourable for irrigation. The C.P.R. Company planned to irrigate much of it with an idea of settling it permanently as a part of its colonization program in the West, in the expectation that a permanent settlement would subsequently generate a large amount of freight traffic for the Company.

This thesis is a study of the land use changes in the District resulting from the introduction and development of irrigation. The acreage under irrigation has increased gradually. Nevertheless, there have been fluctuations in acreage under irrigation due to variations in precipitation and in market demands.

In 1935, the C.P.R.Company transferred the District without charge and with a cash grant to the farmers. As there was no major capital expense, the District became self-sufficient and has since operated successfully. With a surety of good crops and improved market demands, the Eastern Irrigation District has developed a stable and expanding economy. Its future is a much more promising one than that of neighboring dry-land areas which have not developed supplementary water supplies.

ACKNOWLEDGEMENTS

This research has been made possible by the very kind assistance given by a number of persons to whom I should like to express my very sincere appreciation. Foremost of these are Mr. Robert T. White, General Manager, Eastern Irrigation District, Brooks, and his staff. They made available all of the records in their possession of the Eastern Section of the C.P.R. Irrigation Block, from 1912 to 1934, also the E.I.D. records from 1935 to date. Mr. White gave much of his time to seek out other relevant information which is not available in the records.

Others to whom I owe much for their invaluable assistance and patient cooperation include:

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Mr. J. Nesbit, Editor, The Brooks Bulletin, Brooks, Alberta.

Mr. R. S. Ellis, Assistant Director (Agriculture) Census Division, Dominion Bureau of Statistics, Ottawa.

Staff of the Glenbow Foundation Library, Calgary, Alberta.

In addition I want to acknowledge with gratitude the suggestions made by Professors O. F. G. Sitwell and W. M. Schultz and the patience and the constructive criticism of the thesis given by my supervisor Dr. Arleigh H. Laycock, Professor of Geography.

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INTRODUCTION

Purpose and Objectives:

This thesis has been undertaken to trace the land use changes in the Eastern Irrigation District from 1903 when the Canadian Pacific Railway obtained the area as part of a land grant from the Federal Government to the present. In 1903 the District was predominantly a ranching area and only marginally suitable for dry-land farming. It could not attract large numbers of people for permanent settlement because of its semi-arid climate. Following the introduction of irrigation in 1914, the district has gradually changed from ranching and dry-land farming to predominantly irrigated crop production, ranging from cereal grain to forage and specialty crops with closely integrated dry-land grazing. Irrigation is an artificial application of water to the soil, supplementing rainfall, chiefly for the purpose of maturing crops or increasing their yield. Less than 4 per cent of the total improved arable acreage in Alberta is irrigated.[1] The significance of irrigation farming is in its stability, greater productivity and also the greater variety of crops possible for the warmer and drier areas of the province. If the moisture deficiency is overcome the area can contribute more significantly to the economy of the region than is possible under dry-land farming and ranching.

A historical and analytical survey is made of the land use changes from 1903 to 1966-67. The effects of irrigation on land, people's activities, farm based industries and tertiary services are studied. The interrelationships of rural population and irrigation growth patterns are discussed.

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[1] S. Dubetz, G. C. Russell and K. W. Hill, Growing Irrigated Crops in Southern Alberta, Publication 1152, Canada Dept. of Agriculture, Ottawa, April 1962, p. 1.

Irrigation received a great deal of attention from private enterprise in the formative stages of its development in this province. Later on irrigation projects were subsidized and operated by the Provincial and Federal Governments in Canada. The Eastern Irrigation Block was started by the C.P.R. Company in 1911 which operated it up to 1935. It was then transferred to the farmers and named the Eastern Irrigation District as shown. Since 1935 the District has operated successfully under the farmer-elected Board of Trustees.

Location:

The area under study is bounded by the Red Deer and Bow Rivers in the north and south respectively. The eastern limit is the old boundary lines between the Territories of Assiniboia and Alberta and western boundary line is the range-line between Range 18 and 19, and both West of the Fourth Meridian, the western boundary-line turns east between Townships 23 and 24, again it turns north along the range-line between Range 18 and 17, again turning east in Township 25 along the boundary-line of Sections 1 to 6 and Sections 7 to 12, and finally reaching the Red Deer River in the north along the range-line between Range 17 and 16 (see Fig. 1).

Physiographically the District is located in the Southeastern Alberta plains which form a part of the "third prairie level" having an elevation ranging from 2,000 to 3,000 feet above sea level. These plains have been glaciated with the exception of the Cypress Hills and Southern end of the Porcupine Hills respectively south-east and south-west of the district and are covered with glacial debris. The general glacial deposits in the District are till, sand and gravel with very few patches of silt and clay.[2]

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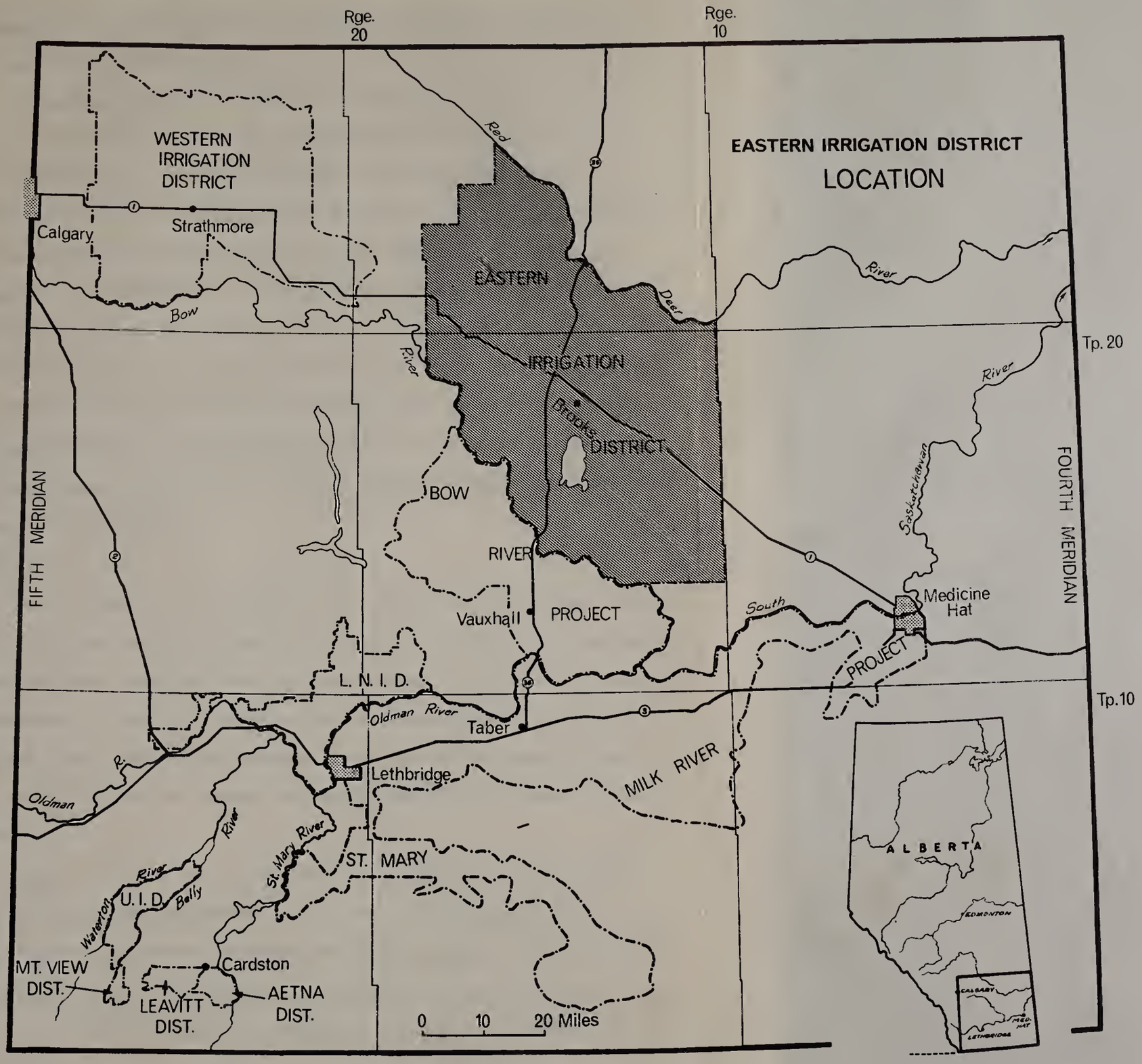
[2]R. Green and A. H. Laycock, "Mountains and Plains," in Alberta - A Natural History, W. G. Hardy (ed.), M. G. Hurtig, Publishers, Edmonton, 1967, p. 81.



Source: Canada Dept. of Agriculture
P.F.R.A., Engineering Branch.

Fig. 1

The topography is rolling and does not present any serious obstacle for canal construction and irrigation.

According to Koeppen's climatic classification most of Alberta lies in the Humid Microthermal zone including Humid Continental, Cool Summer and Subarctic.[3] However the Eastern Irrigation District is transitional from Humid Continental Cool Summer Dfb to Mid Latitude Steppe BSK. The rainfall is deficient and the common vegetation is limited to short grass. Lack of moisture is the principal limiting factor in the fertility of the area. The soils are also low in nitrogen and phosphorus, but under irrigation or in a wet year will respond to fertilizers supplying these elements. Ranching is the most suitable land use and only the most favourable soil types can be considered arable. Wheat is the principal crop where farming is practiced. A long frost-free period has assisted the development of irrigation.

Procedure:

As this thesis is a historical study of the land use changes in the Eastern Irrigation District since 1903, many of the data have been gathered from the available Canadian Pacific Railway Company records presently in the possession of the E.I.D., the Glenbow Foundation Library in Calgary, air photos, other publications pertaining to this area and personal interviews. The field work was carried out in the area from September 1966 to July 1967.

Many of the data up to 1934 have been collected from the Eastern Section (Operation and Maintenance) Annual Reports, Canadian Pacific Railway Company, Department of Natural Resources, Calgary. These are quite

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[3] "Atlas of Alberta", Govt. and University of Alberta, Edmonton, 1968, p. 18.

accurate bases for the compilation of graphs of production for the area. The data collected from the Ditch Riders' Reports[4] submitted to the E.I.D. are the bases for the figures and tables after 1935.

The soil map of the E.I.D. is compiled from various Soil Survey Sheets published by the University of Alberta, College of Agriculture from 1926 to 1943. The air photos of the District on the scales of 1":3333 feet and 1":2640 feet taken in 1930 and 1962 respectively were checked for preparing the land use map. A comparative study of soil patterns and the land use in 1962 is made to determine some land use patterns. A comparison of population increase from 1901 to 1961 by township and the land use in 1966-67 in the District is made to show some of the relationships involved between population increase and land use changes. The available data are placed in an historical setting and related to pertinent physical and cultural elements to provide a comprehensive survey of the effects of irrigation in the expansion of more intensive land use.

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[4] A ditch rider is an employee of the irrigation district who turns the water on and off and looks after the maintenance of the main canals and ditches which deliver the water to the farms. The E.I.D. has 28 Ditch Rider Units in its six Watermaster Divisions.

CHAPTER I

PHYSICAL SETTING OF THE EASTERN IRRIGATION DISTRICT

Geology

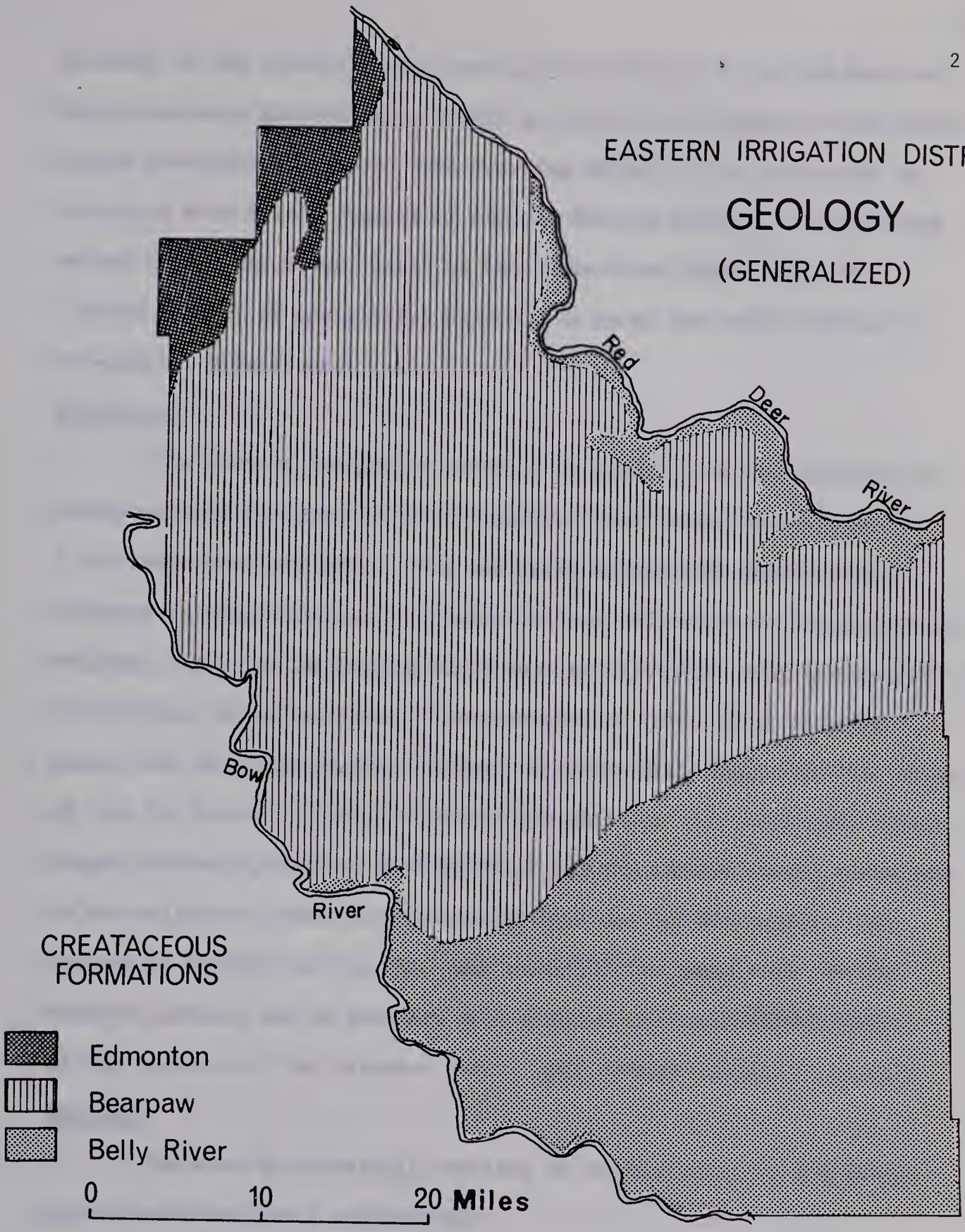
The bedrock of the district consists of Upper Cretaceous formations of horizontally bedded young sedimentary rock of marine and continental origin. The horizontal bedding contributes to the low relief; the marine formation to the sometimes saline soil and groundwater conditions. The entire area was covered by the Continental Ice Sheet which melted from this area some 10 to 20 thousand years ago. There is a mantle of glacial drift, mostly till, over the area covering the bed-rock. The depth of this till is from a few feet to over 100 feet. Much of the area was subjected to post-glacial sorting and there are large areas of aeolian, alluvial, and lacustrine surface deposition varying in thickness from a few inches to several feet. Therefore going from the surface down, there is: a layer of fairly permeable sorted material, considerable depth of slowly permeable glacial till, and then relatively impermeable bedrock. The area east of South Saskatchewan River, north to township 19 and the area west of a line from Lake Newell running north-easterly through Jenner and up to township 24, range 8, is underlain by Bearpaw Shale. The rest of the south-eastern part of the area and the valley of the Red Deer River is underlain by the Belly River pale beds of fresh-water sands and sandy shales. The north-west corner of the study area is underlain by Edmonton formations. It is a very narrow band which is irregularly weathered (see Fig. 2).

The post-glacial deposition has produced a rolling terrain in the study area. The general elevation ranges from 2700 feet in the north-west (Crawling Valley area) to 2500 feet in the east and along the south-east

EASTERN IRRIGATION DISTRICT

GEOLOGY

(GENERALIZED)



Source: Geology Survey Division
Research Council of Alberta
Edmonton, Alberta, 1937.

Fig.2

boundary of the district. The post-glacial valleys of the Red Deer and Bow Rivers were incised quite easily in parts of the region in the drift-filled pre-glacial valleys. The Crawling Valley in the north-west of the study area is the remnant of the Bow Bedrock Channel.[1] The present valley of the Bow River, south of the "Horse-shoe Bend" shows the limited control of pre-glacial period. It shows the major effects of pro-glacial diversions.

Topography

The Eastern Irrigation District in Alberta has an undulating to gently rolling topography and the general elevation is about 2,500 to 2,700 feet above sea level. The two other significant physiographic features in this area are the Little Rolling Hills and the Dinosaur Park badlands. The Little Rolling Hills have an elevation ranging from 2500 feet to 2800 feet above sea level. The gradient of these hills is quite gentle and the lower southern fringes of these hills extend to the valley of the Bow River. In the north-east the elevation in the badland area ranges between 2,200 feet to 2,500 feet and the contours are quite close in the valleys of small creeks flowing into the Red Deer River. The bedrock is exposed in this area and the valley is quite wide and the badland features can be seen for many miles from southern viewpoints at the entrance of the Dinosaur Park. (See overlay on Fig. 9, p.62).

Drainage

The area is principally drained by the Red Deer and Bow Rivers in the north and south respectively.

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[1] C. P. Gravenor and L. A. Bayrock, "Glacial Deposits of Alberta," in Soils in Canada, R. F. Legget (ed.), The Royal Society of Canada Special Publications, No. 3, The University of Toronto Press, Toronto, 1965, p. 34.

The Red Deer River rises in the Sawback Range of the Rocky Mountains. It flows eastward for about forty miles, then in a north-easterly direction for eighty miles to a point near the City of Red Deer. From here the river flows in a south-easterly direction to its confluence with the South Saskatchewan River in township 22, range 28, west of the 3rd meridian. The total length of the river is approximately 400 miles. The valley of the Red Deer River is wide and deep in this area and the banks are rough and cut up with a large number of deep coulees. In the upper reaches the drainage basin is well timbered and a fair growth of timber continues along its banks for some distance out on the prairies.

The post-glacial valley of the Red Deer River is deeply incised into the plain, and varies in depth to 350 feet below the general plain level. The valley is over one mile wide in most places. The widest part of the valley extends from the vicinity of Steveville south through ranges 12 and 11, where it varies from 3 to 4 miles in width. The valley gives extensive exposures of rock formation from north-west to south-east of the area. The following tributaries, which have only a seasonal flow, enter the river from the south in the study area: Matzhiwin Creek, One Tree Creek, and Sand Hill Creek. At present these three are used to carry irrigation spill water. There are other small drainage channels that carry spring run-off.

The Bow River rises in Bow Lake, elevation 6,430 feet, which is just east of the Great Divide. The river flows in a south-easterly direction to the City of Calgary where it turns and flows south for approximately twelve miles and then continues in a south-easterly direction to a junction with the Oldman River at Grand Forks in township 11, range 13, west of the fourth meridian. The main tributaries of the Bow River are the Cascade, Ghost, Spray, Kananaskis, Elbow, Sheep and Highwood Rivers.

These and other tributaries of the Bow River rise in the mountains and generally carry water all year although the volume varies greatly with the seasons. The removal of timber from the mountain slopes, either by industry or by fire, adds to the seasonal fluctuations. Such removal of the protective vegetative cover increases soil erosion, increases the danger of being unable to obtain sufficient water during the late summer months.[2] With increased demands being made on these streams for irrigation and other uses such fluctuations may be serious.

In the study area a number of drainage creeks are tributary to the main river and carry water at only certain seasons of the year. One of the most important of these is Twelve Mile Coulee, which drains south and empties in the Bow River. It is also used for surplus irrigation drainage. The Antelope Creek is also used as a part of the irrigation system and it finally drains into the Bow River.

Table I represents the mean monthly average discharge of the Red Deer and Bow Rivers in cubic feet per second from 1911 to 1955 at Red Deer and Calgary respectively. The Bow River has about twice the discharge of the Red Deer. In comparison to the Red Deer River, the Bow River has been more fully utilized for irrigation and industrial purposes. The Red Deer River has a potential for agricultural use but it is not utilized. It was planned to be used for irrigation after the thirties. This plan has not been fully materialized.

The Bassano Dam is built at a curve on the Bow River known as the Horseshoe Bend. Water is diverted from this reservoir to feed the Eastern Irrigation District by series of canals leading north-east, east

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[2]F. A. Wyatt, et al., Soil Survey of Blackfoot and Calgary Sheet, Bull. No. 39, University of Alberta, Edmonton, 1942, pp. 16-17.

TABLE I

MEAN MONTHLY AVERAGE DISCHARGE OF RED DEER AND BOW RIVERS
(1911 - 65)

River and Station	Drainage Area Square Miles	Oct. cfs	Nov. cfs	Dec. cfs	Jan. cfs	Feb. cfs	Mar. cfs	Apr. cfs	May cfs	June cfs	July cfs	Aug. cfs	Sept. cfs	Total ac-ft
Red Deer at Red Deer	4,420	1,182	669	364	304	298	580	2,288	3,029	4,934	3,685	2,430	1,941	1,302,000
Bow at Calgary	3,000	2,240	1,700	1,440	1,380	1,350	1,390	1,830	3,620	8,460	7,290	4,750	3,260	2,351,000

Note: These data have been used by the "Atlas of Alberta," Govt. and University of Alberta, Edmonton, 1968.

Source: Department of Northern Affairs and National Resources - Water Resources Branch, Ottawa.

and south-east. Irrigation reservoirs in use to store Bow River water are as noted in Table II.

TABLE II - LOCATION AND CAPACITY OF WATER RESERVOIRS IN THE E.I.D.

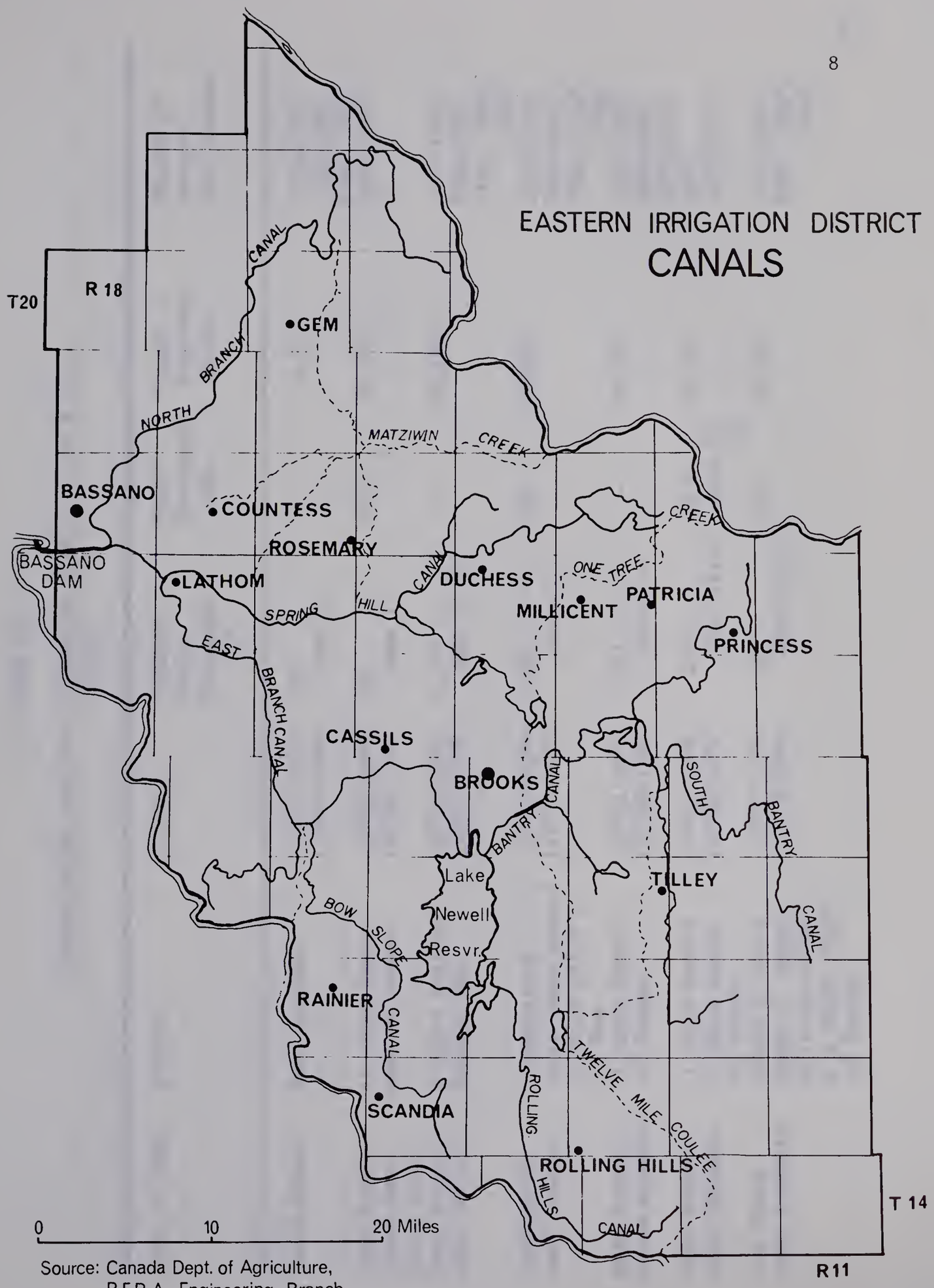
Name of Reservoir	Location	Capacity in Acre-feet
Lake Newell Reservoir	Twp 17, rgs. 14 & 15	187,300
Cowoki Reservoir	Twp 18, rg. 13	14,000
Sutherland Reservoir	Near Brooks	8,000
Rolling Hills	South of Brooks	5,677

Source: B. Russell, Report on Surface Water Supplies and Water Power of Alberta, Their Present and Ultimate Uses, Alberta Dept. of Agriculture, Water Resources Branch, Edmonton, 1948, p. 24.

From the headgates the main canal runs eastward for 3.22 miles following a natural depression and ends at a dam across the valley known as the "Little Dam". The Little Dam is the real starting point of the canal distribution system in the Eastern Irrigation District. From here start the two main canals, the North Branch and the East Branch. The North Branch running northward from the Little Dam and passing about one mile east of the town of Bassano toward Gem is about 41.7 miles long (see Fig. 3).

The East Branch leading off in a south-easterly direction follows an old drainage course by way of Lathom to Coyote Valley in Township 18, range 16. Here the canal branches, one branch crossing the valley by means of a flume to feed Lake Newell, south of Brooks and other leading south-east toward Rainier. The other main branch from the East Branch canal is Spring Hill Canal which flows east and then north-east.

The following chart gives canal flow data during the irrigation season (May to Oct.) for the assessment of water supply during the irrigation period (see Table III).



Source: Canada Dept. of Agriculture,
P. F.R.A., Engineering Branch.

Fig.3

TABLE III

SURFACE WATER DATA FOR IRRIGATION CANALS IN THE E.I.D.
(1965)

Name of Canal	Station	Location	Maximum daily Discharge cfs	Mean Discharge cfs	Total Discharge ac-ft	Period of Record Irr. Season
North Branch	Near Bassano	50°47'20"N 112°26'10"W	502 June 16	-	54,150	1914-1930 1945-1965 Misc. 1944
East Branch below Bow Slope Canal	10 miles South west of Brooks	50°30'49"N 112°08'33"W	661 June 17	247	89,970	1964,1965
East Branch near Lathom	8 miles east of Bassano Dam	50°43'20"N 112°20'20"W	1,340 June 15,16	-	195,000	1917-1930 1945-1965 Misc. 1942, 1944
Springhill near Lathom	(Immediately below head gates) 8 miles below B. Dam	50°43'20"N 112°20'20"W	825 July 30	274	100,000	1917-1930 1945-1965 Misc. 1942, 1944
Main Bantry above Aqueduct	3 miles South of Brooks	50°31'35"N 111°52'13"W	651 June 10	-	80,680	1917-1918, 1922-1925 1955-1965
West Bantry near Headgate	3 miles east & 2 miles south of Brooks	50°32'05"N 111°49'10"W	202 June 11,14	66.8 June 11, 14	24,390	1918, 1955-1965
Bow Slope near Headgate	About 16 miles above L. Newell & 11 miles west & 4 miles south of Brooks	50°30'10"N 112°08'50"W	392 June 16,17	190	69,320	1955-1965 Misc. 1942, 1943

TABLE III (continued)

Name of Canal	Station	Location	Maximum daily Discharge cfs	Mean Discharge cfs	Total Discharge ac-ft	Period of Record Irr. Season
Rolling Hill near Headgate	Southeast corner of L. Newell & 13 miles South of Brooks	50°22'25"N 111°52'50"W	267 June 15	-	22,170	1955-1965 Misc. 1942, 1943
Antelope Coulee Spillway	1½ miles north & 3 miles east of Eyremore Post Office	50°27'20"N 112°09'40"W	- -	3.6 (May to Oct.)	1,320 (May to Oct.)	Mainly May to October, 1959 to 1965

Source: Surface Water Data-Alberta, 1965;
Water Survey of Canada, Inland Water Branch,
Dept. of Energy, Mines & Resources, Ottawa, 1967, pp. 153-161

Lake Newell Reservoir is a storage reservoir supplied with water from the East Branch and Bow Slope Canals. Two canals take out from Lake Newell Reservoir in the north and south, namely Bantry and Rolling Hills respectively (see Fig. 3).

More-or-less the higher area along the C.P.R. tracks between Bassano and Suffield forms the water-divide between the drainage to the north-east (Red Deer River) and south-east (Bow River).

Climate

The climate of this area is typical of the drier and warmer high plains region of Western Canada. It is characterized by long bright moderately warm summer days and bright cold winter weather. The average wind velocity at Brooks is about seven miles per hour. The most frequent direction of wind movement is from the west and north-west, although the strongest winds are from the south-west. This area is in the path of the chinook winds, although they do not occur as frequently as they do nearer to the Rocky Mountains. They do, however, very often melt the snow enough to permit winter pasturing. These winds are dry and may be very harmful during the growing months. The average hours of sunshine during the prolonged growing season (May to September) in the Eastern Irrigation District varied between 1,220.6 and 1,587.9 from 1926 to 1940. The average number of hours of sunshine per growing season (14 years average) has been 1,328.8 hours with an average daily amount of 8.6 hours (see Table IV).

Meteorological records show that there is a greater evaporation from a free water surface in the treeless plains of Alberta than in the park zone. This is because of higher average temperature, high and more frequent winds and less cloud cover.

Table V compiled from the Dominion Meteorological Records, shows the average monthly distribution of precipitation for a period of thirty

TABLE IV

HOURS OF SUNSHINE DURING GROWING SEASON, 1926-40

Year	May	June	July	August	September	Total
1926	280.2	321.8	356.5	250.4	145.4	1,354.3
1927	161.4	289.5	354.6	292.5	196.8	1,294.8
1928	334.0	220.2	329.9	306.6	241.1	1,431.8
1929	249.8	270.2	385.7	352.8	170.0	1,428.5
1930	244.8	272.2	358.7	- - -	not available -	- -
1931	225.8	242.0	308.2	299.0	145.6	1,220.6
1932	210.3	212.4	322.4	281.4	212.6	1,239.1
1933	225.4	308.2	359.2	284.4	182.6	1,359.8
1934	215.9	242.2	349.5	308.9	141.6	1,258.1
1935	217.7	223.2	341.7	288.2	205.8	1,276.6
1936	297.4	257.8	361.5	259.0	197.5	1,373.2
1937	264.0	264.9	301.8	287.7	178.7	1,297.1
1938	192.9	231.2	324.2	296.5	269.5	1,314.3
1939	246.5	211.3	344.6	307.1	197.4	1,306.9
1940	269.3	309.9	267.9	340.2	200.6	1,587.9
AVERAGE	242.3	258.5	337.7	276.9	179.0	

LONG FROST-FREE PERIOD

TEMPERATURES FOR THE YEARS 1926 to 1940
FOR THE GROWING SEASON (APRIL-SEPTEMBER, BOTH MONTHS INCLUDED)

	April	May	June	July	August	September
Maximum mean	55.8°	67.3°	74.8°	82.8°	78.9°	66.7°
Minimum mean	27.9°	39.6°	47.6°	52.8°	48.8°	38.8°

Killing Frost-Free Period (15-years average) - 139.2 days
This compares favourably with similar areas in the Prairie Provinces
Wind Velocity, May-September period (15-year average) - 8.5 M.P.H.

Source: E.I.D. Records.

Note: Recent complete data for all the stations in the E.I.D. are not available for up to date calculations.

TABLE V - SEASONAL DISTRIBUTION OF PRECIPITATION AT SELECTED STATIONS IN SOUTHERN ALBERTA

	Medicine Hat 1931-1960	Jenner 1931-1960	Brooks 1931-1960	Gem (1917-1935)*	Gleichen 1931-1960	Calgary 1931-1960
January	.85	.69	.67	0.60	.65	.68
February	.80	.64	.68	0.67	.84	.78
March	.98	.73	.82	0.79	.96	1.01
April	.98	.73	.85	1.26	1.16	1.36
May	1.64	1.44	1.61	1.35	1.70	2.03
June	2.32	1.97	2.26	1.75	2.70	3.45
July	1.36	1.22	1.49	1.46	2.02	2.30
August	1.54	1.70	2.05	1.27	1.82	2.30
September	1.49	1.33	1.29	1.07	1.07	1.37
October	.81	.79	0.70	0.54	.86	0.89
November	.77	.68	0.54	0.72	.65	0.63
December	.75	.57	0.59	0.59	.56	0.61
Total	14.29	12.49	13.55	12.07	14.99	17.44

*Data from nearby stations have been supplied for months that were not reported.

Source: Precipitation Norms for Alberta (CDS No. 5-65), Climatology Division, Meteorological Branch, Toronto, May 14, 1965, pp. 3-6.

years at Brooks and other selected stations in southern Alberta. In the case of Gem, recent complete meteorological data are not available. It is also shown by these generalized data that precipitation increases from east to west. The distribution of precipitation at Brooks is representative of the Eastern Irrigation District. It may be seen from Table V that about 43 per cent of the average annual precipitation at Brooks for the thirty year period, 1931-60, fell during the summer months of June, July and August. In the growing season, May, June and July almost 35 per cent of the yearly rainfall was received and approximately 75 per cent fell during the months of April to October inclusive. May is one of the important growing months and moisture deficiency may effect the germination. The marginality in precipitation exists in spite of its comparatively favourable distribution - most of it occurring during months of April to October. It is during these months precipitation is most effective for crop growth. The predominance of precipitation in the growing season supplemented by the previous winter precipitation does not eliminate the problem of drought. Drought occurs when the amounts of moisture needed for plant transpiration, run-off loss, and losses through evaporation are greater than the total amount of storage plus natural rainfull. The overall average deficiency (precipitation minus evapo-transpiration) would approximate 10 inches each year. This situation indicates that irrigation is essential for the area for growing crops.

The frost-free period has a considerable bearing on the risk of producing certain crops and the variety of crops grown. It must be noted that frost-free period is ended by one degree of frost, and in many cases this slight amount of frost would not harm many of the farm crops. Thus the frost free period is seldom as long as the growing season. It may be of interest that in 1936 one farmer in the Tilley area, under irrigation,

marketed wheat 87 days after seeding.[3]

Table IV (see p. 12) shows the maximum and minimum temperatures for the years 1926-1940 calculated for a prolonged growing season, April to September. The average maximum and minimum mean temperatures for the six months are 71.1° F and 43.6° F respectively. The high temperature for six months increases evaporation in the District and retention of moisture becomes quite low. But it also decreases the danger of frosts for the crops. According to calculations made by Dr. Laycock[4] for all the Prairie Stations for all the years on record in the period 1921-50, the seasonal moisture surpluses are small and present only in some of the years in south-eastern Alberta. The average surpluses are Vauxhall 0.6", Lethbridge 1.7", Medicine Hat 0.8", Strathmore 0.6", Hanna 0.6", and Brooks 0.3". These surpluses occur in the spring of some years and are succeeded by much larger deficiencies in the summer and fall of almost all years. The calculations of average deficiencies are based on the Thornthwaite procedures. The supplement of water is required if we wish to have a variety of crops. There is a possibility of optimum moisture supplies for growth in some years but moist years occur infrequently and severe drought is much more common.[5] It seems irrigation is most successful in the areas with high frequency of drought because the farmers have minimum dependence on rain for required moisture supplies for a full growing season varies from year to year.

Because of the factors reviewed it is essential to provide irrigation in the Eastern Irrigation District. The supplement of moisture

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[3]F. A. Wyatt, et al., Soil Survey of Rainy Hill Sheet, Bull. No. 28, University of Alberta, Edmonton, Aug. 1937, p. 7.

[4]A. H. Laycock, The Climate of the Bow River Project Area: Regional Comparison and Local Variations, (Mimeographed), Dept. of Geog., University of Alberta, Edmonton, 1961, pp. 2-4.

[5]Ibid., p. 5.

deficiency is required to warrant a regular growth of various crops. The possibility of specialty crops increases with irrigation.

Vegetation

The study area comprises part of the brown soil zone and the "bald prairie" of south-eastern Alberta. As this suggests, there are no native trees in the upland plains of this area. The eroded faces and banks in the badland area are almost devoid of vegetation but have patches of prairie grass and other plants on the more favourable sites. Among the more conspicuous species are the sage brushes, creeping juniper and bear berry. On flats between the badland hillocks, cacti are prevalent.

Clarke[6] (1930), in his pioneer grazing-land studies, refers to the vegetation of the brown soil zone as a short-grass formation comprising two chief types which he designates Bouteloua - Stipa - Koeleria and Agropyron-Poa Association. Moss[7] (1932) speaks of the same region as Southern Prairie and gives Bouteloua gracilis, Stipa comata, Agropyron smithii and Koeleria gracilis as the dominant species. Hubbard[8] (1950) expressed the opinion that "Short Grass" is predominant and is dominated by Bouteloua gracilis species in the brown soil zone. According to Coupland,[9] the Mixed Prairie or Stipa-Bouteloua association is dominated by six grass species, namely, Stipa comata, S. spartea var. curtiseta, Bouteloua gracilis, Agropyron dasystachyum, A. Smithii and Koeleria cristata, while a seventh grass, Muhlenbergia cuspidata, is dominant in eroded areas. There are other grass species and sedges characteristic of the area but they are not dominant.

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[6]As cited in E. H. Moss, "The Vegetation of Alberta," The Botanical Review, Vol. XXI, Nov. 1955, No. 9, p. 507.

[7]Ibid., p. 507.

[8]Ibid., p. 507.

[9]Ibid., p. 508.

The chief sedge is Carex eleocharis. Broad leaf trees grow in the depressions where water accumulates from surface flow, or ground water flow and where this water is not too saline. In shelter belts, where snow accumulates in winter, there is an appreciable growth of trees due to this extra moisture.

Sand grass and liqorice are quite abundant in the sandy areas. The sand grass gives a fairly luxuriant growth and remains green well into the fall. The liqorice plant is a tall legume with red colored seed pods covered with burrs. This plant is not relished by the stock.

A gold flowered thistle of low growing habit is a characteristic plant in the blow-out spots. It appears to be the first growth to survive on the exposed hard B horizon.

Russian thistle is possibly the commonest weed. It is found in the cultivated fields, on deserted farms and along the roadsides. Its ability to produce growth under extremely dry conditions is well known. They can be and are in some places used as feed although they have a very high salt content. In the fall of 1936 both cattle and hogs were seen pasturing on young thistle.[10] In many cases thistle of tumbling variety grows on the deserted farms and in four or five years after the farm is deserted thistle and mustard become the pioneer plants.

Soils

The soils of the Eastern Irrigation District are largely derived from glacial drift, some of which came from the underlying rock formations. The presence of granite and gneiss erratics from the Canadian Shield region suggests that some material has been transported long distances, but much of

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[10] F. A. Wyatt, et al, Loc. cit., p. 43.

the soil is derived from the parent rocks in the vicinity.

The underlying formations consisting of sand-stones and shales form at least part of the parent material of the soils of the area. The soil is the product of the weathering and mixing of these sand-stones and shales and drift. It is therefore expected that most of it would be of an intermediate texture. Only in the areas where considerable sorting has taken place are the purer classes of sand and clay found. The lime content which is often quite high, may come from a calcareous sandstone cement. Bearpaw shales generally contain much gypsum. It is found as large intrusions of crystals between the layers. The subsoil of the western part is underlain by marine Bearpaw shales and is quite high in salts. The intrusions of crystals can be easily seen. The distribution of soils by texture in the area is noted in Table VI.

Table VI shows the approximate distribution of various soil textures in the Eastern Irrigation District. These soils are generally of a medium texture. The soil types such as loams, silt loams and fine sandy loams are over 75 per cent in the District. Such intermediate soils are well adapted to irrigation. They absorb water freely and possess fairly high retentive power. In addition to the favourable texture these soils are comparatively high in limestone and consequently are well adapted to the growth of legumes.

Legumes improve the soil not only from a physical standpoint but also add to the fertility of the soil in the nitrogen fixation processes. These also form the foundation of a systematic rotation with livestock.[11]

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[11] C. C. Spence, B. H. Kristjanson and J. L. Anderson, Farming in Irrigation Districts of Alberta, Technical Bull. No. 61, Dominion of Canada Dept. of Agriculture, Ottawa, Nov. 1947, p. 16.

TABLE VI - DISTRIBUTION OF SOILS BY TEXTURE IN THE E.I.D., 1942*

Soil Texture	Percentage
Clay	1.4
Silty clay loam	-
Clay loam	4.3
Silt loam	24.9
Loam	36.3
Fine sandy loam	14.0
Sandy loam	6.6
Fine sand	2.6
Sand	2.8
Marshes, lakes, etc.	7.1

Total area of the District: 1,500,000 acres

*Calculated by planimeter scaling on available soil maps prepared by the Department of Soils, University of Alberta.

Source: C. C. Spence, B.H. Kristjanson, and J. L. Anderson, Farming in the Irrigation Dists. of Alberta, Technical Bull. No. 61, Dominion of Canada, Dept. of Agriculture, Nov. 1947.

In Figure 4, a generalized distribution of soil types and irrigated areas is represented. The generalized irrigated areas are based on the ARDA Land Use maps prepared from 1962 air photos on a scale of 1":2640 feet. It would appear that loams are less commonly irrigated because these are higher and rough moraine areas. But most irrigated soil types in the District are silt loam and fine sandy loam.

In the Rolling Hill area, fine sandy loams and loams are not widely used in irrigation. If demands for crops and livestock feed increase, the present irrigated areas will be extended without much expense. In the Scandia, Ranier and Bow City areas, fine sandy loam, fine sand, loam and silt loam soil types are irrigated. These soils are mostly used for legumes, livestock and potatoes in Ranier area. If the demand for livestock or potatoes increase, these areas could be extended with some costs. In the Tilley, Brooks and Duchess areas silt loams are the most widely used in

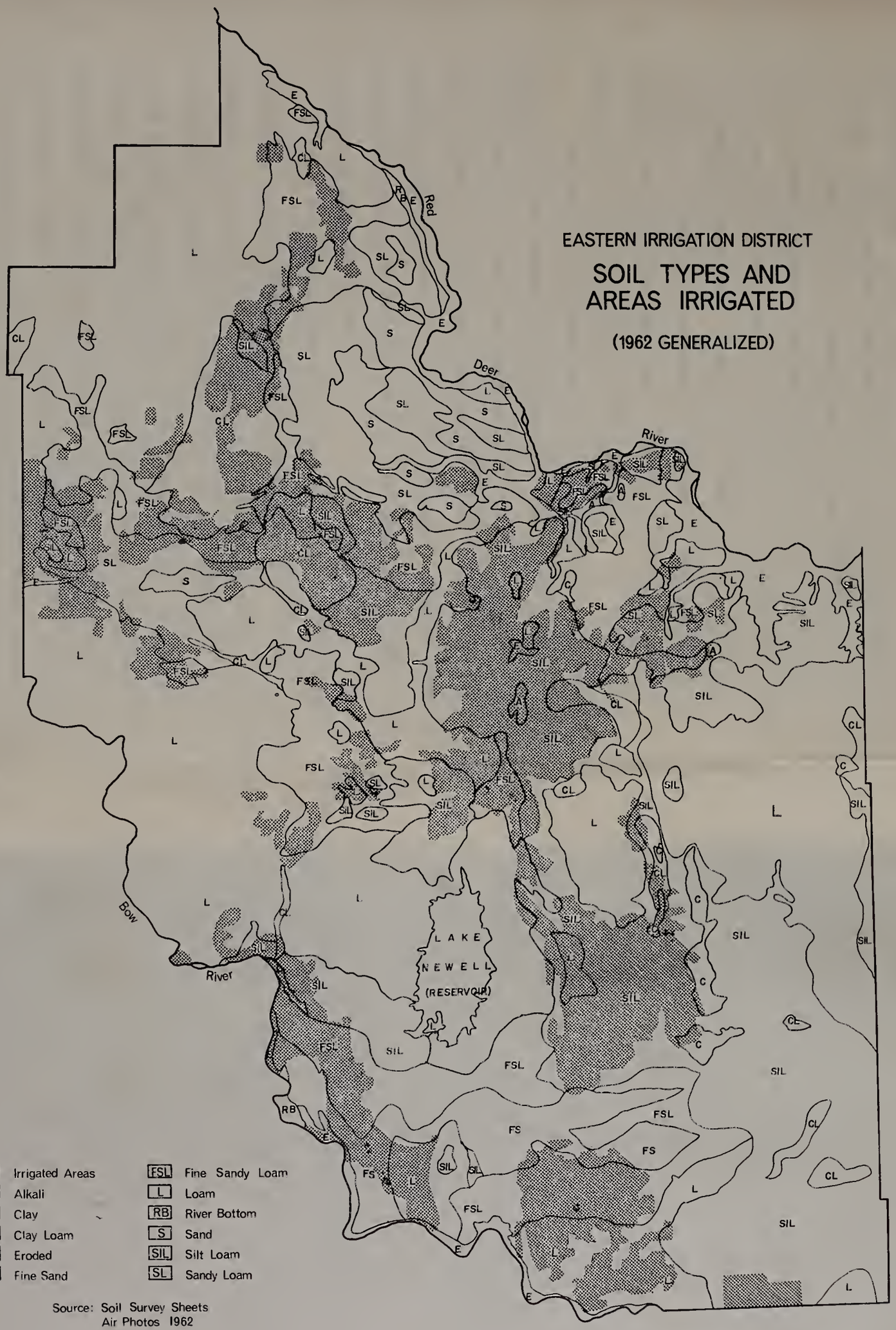
EASTERN IRRIGATION DISTRICT
SOIL TYPES AND AREAS IRRIGATED
(1962 GENERALIZED)
Red River
Deer River
Bow River
LAKE NEWELL (RESERVOIR)
Irrigated Areas
A Alkali
C Clay
CL Clay Loam
E Eroded
FS Fine Sand
FSL Fine Sandy Loam
L Loam
RB River Bottom
S Sand
SIL Silt Loam
SL Sandy Loam
Source: Soil Survey Sheets
Air Photos 1962
0
10
20 Miles

Fig. 4

irrigation. Depending on the increased demands, the loam and silt loam area between Tilley and Brooks, northeast of the C.P.R. line could be utilized. There are great possibilities for irrigation extension to the east of the present area by gravity and lift pump irrigation where there are fewer solonetzic problems (see Fig. 28, p. 101 and overlay) showing the areas named above). In the Rosemary, Gem and Bassano areas, silt loam, fine sandy loam, loam and clay loam are under irrigation farming. As a result of judicious use of water and better agricultural knowledge the farmers in these areas have increased their irrigated acreage since the first delivery of water in 1914.

Presently 192,324 acres are irrigated in the District,[12] but with an increased demand for irrigated crops, there is a great possibility for an extension of the total existing areas. With these possible extensions an area of 76,000 acres (see Fig. 28, p.101) could be added to the presently irrigated areas. The soils of the Eastern Irrigation District are quite suitable for irrigation due to their texture and fairly high retention storage capacities.

As a result of a wide range of suitable soils and favourable terrain, irrigation permits the growing of a wide variety of crops in the district such as alfalfa, potatoes, sugar beets, cereal grains, peas, beans, forage crops and grasses, sweet corn, etc. Alfalfa grows well in a dry, sunny climate, on well-drained soil with adequate moisture. Potatoes grow best on loam or sandy loam with good drainage. Sugar beet grows well in many types of soil, from heavy clay to sandy soil; under irrigation, loam is the best. They do well in soils with moderate amounts of salts, but not on land with the water table near the surface. Other crops are grown

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[12]P.F.R.A., The Annual Cost of the Eastern Irrigation District, Canada Dept. of Agriculture, Alberta Regional Engineering Division, Calgary, May 1965, p. 9.

in different parts of the district except in areas having mixed soils, river bottom deposits, eroded slopes and alkali soils.

A detailed account of each soil type in the Eastern Irrigation District is given below.[13] The soil map (see Fig. 5) of the District is compiled from the Soil Survey Sheets (1925-43) of the south-eastern part of Alberta published by the University of Alberta, Edmonton. The overlay on the map (see Fig.5) shows the rolling, hilly, gravel and sand dune areas. The legend for the overlay is given on the soil map. The general description of soil types present in the District is based on the available soil surveys. Mostly these soil types are suitable for irrigated crops and the climatic conditions warrant an expanding irrigation agriculture.

FINE SAND: The area in the south-east of the Bow River belongs to the fine sand type since the material is largely fine and very fine sand. The subsurface and subsoil are about the same texture as the surface soil, and vary from a few feet to over thirty feet in depth, especially in the dune area. The surface soil varies in colour from dark brown to light brown.

The topography is undulating to rolling with certain areas of dunes and hills. The sand areas are primarily a result of the weathering of the country sand-stones and some glacio-fluvial sorting. This sorting has occurred in the sand hills just south of the Little Rolling Hills in township 16, range 14, west of the fourth meridian.

The sands are incoherent in nature, and blow readily once the grass covering is disturbed. They are well drained and absorb water readily. These areas have proved profitable after irrigation. In areas under irrigation, these soils may cause trouble from over irrigation, especially where the sandy nature is shallow and rests on an impervious horizon. In the Rolling

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[13] F. A. Wyatt, et al., Ibid., pp. 13-29.

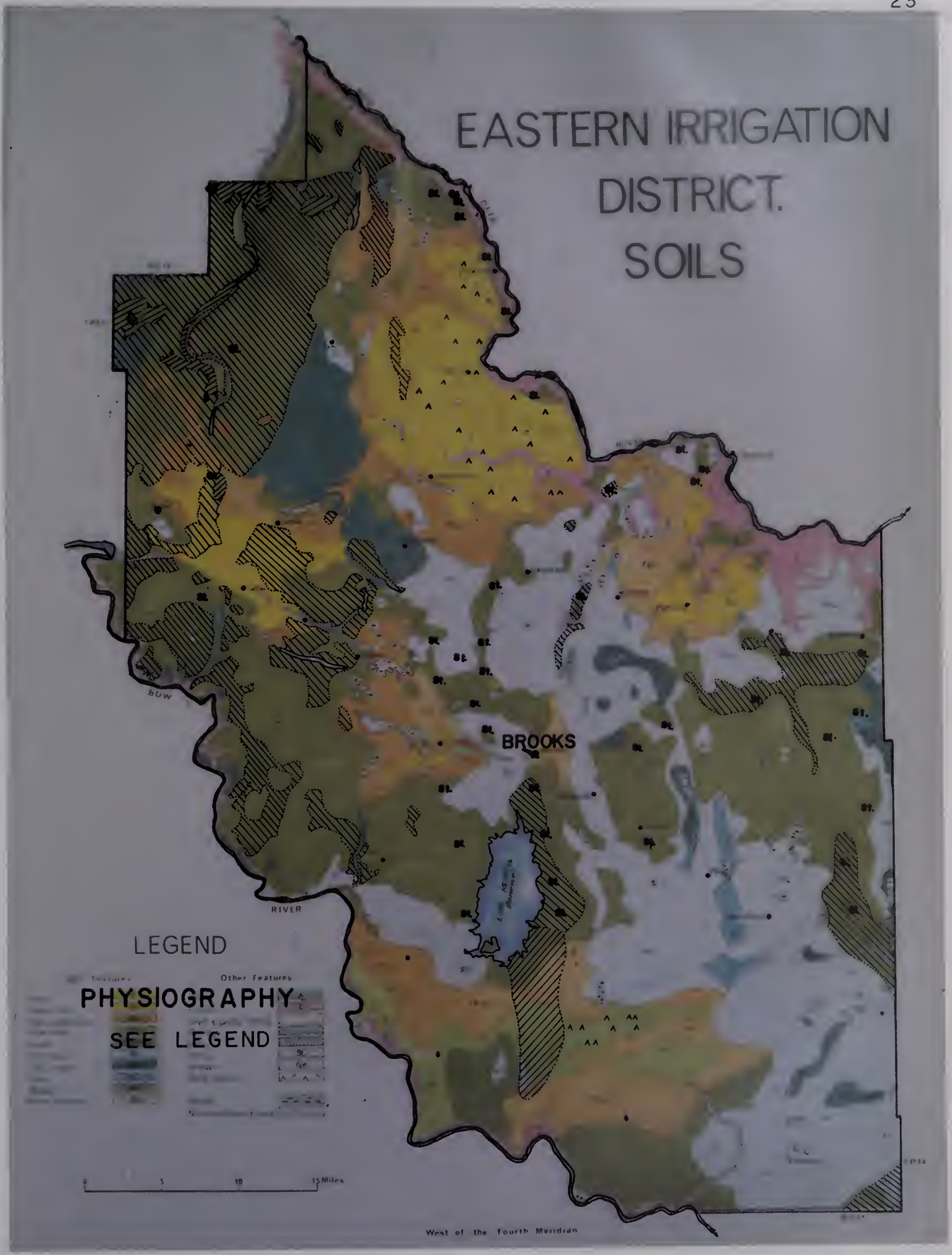
EASTERN IRRIGATION
DISTRICT.
SOILS
BROOKS
BOW
RIVER
LEGEND
Other Features
PHYSIOGRAPHY
SEE LEGEND
0 5 10 15 Miles
West of the Fourth Meridian

Fig. 5

BROOKS
PHYSIOGRAPHY
SEE LEGEND

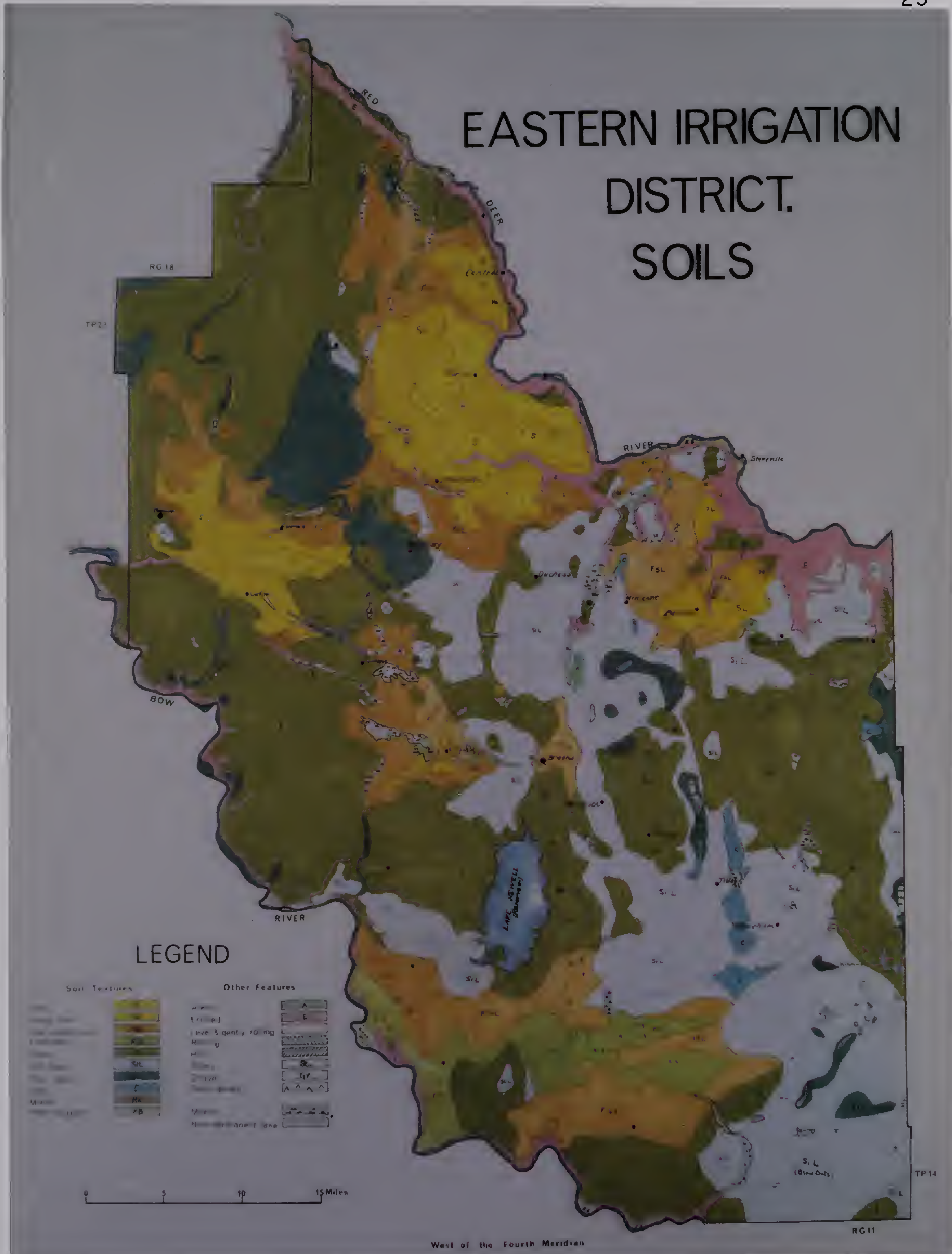
EASTERN IRRIGATION DISTRICT. SOILS
RED
DEER
RIVER
BOW
RIVER
RG 18
TP 23
TP 14
RG 11
Steveville
Duchess
LAKE NEWELL
LEGEND
Soil Textures
Other Features
15 Miles
West of the Fourth Meridian

Fig. 5

Hills and Scandia areas, as a result of irrigation, these soils produce alfalfa well with irrigation.

SAND: It belongs to the eolian series which have been formed on material that has been sorted out and deposited by wind and water. It is supposed that these sands have been formed from the sand-stones of the underlying formations. The color of the sand is usually quite uniform for considerable depth and varies from a light yellow to a medium brown. The surface may be darker due to the presence of organic matter which varies from practically nothing in the active dunes to a slight accumulation for a depth of eight to ten inches in the more fixed areas.

The sands in the map area are of medium texture. Most of the dunes are covered with a fairly heavy growth of rosebush, liqorice, and sand grass, that is effectively holding them from further movement. The sand area, possibly having its origin from Edmonton and Fox Hill sand-stones, is formed on otherwise level topography and is practically stone free (see the overlay on soil map). In general the clay strata below is close to the surface, therefore bringing the water table quite close to the surface. Running springs from the contact of the sand and clay are frequent along the banks of the eroded coulees.

The sand areas have a very low plant food content when compared with the heavier soil types, and since the soil presents a drifting problem as soon as the surface is broken, it is imperative that they remain entirely for grazing purposes. (see Fig. 28, p.101) Their usefulness, in this area, would seem to be best realized by utilizing their pasture possibilities.

SANDY LOAM: These soils have been formed on material that has been subjected to water sorting, and consequently they are generally located along drainage courses. They are all of light texture, they may contain stone, and there

is a large variation in the closeness to the surface of the heavier soil.

In townships 18 and 19, range 13, there is a sand deposition varying from three to at least seven feet in depth. The lower horizons are quite loose and sandy, but the surface shows some profile development and it is fairly well supplied with organic matter. There is considerable rosebush growth over the area, but only a fair to poor grass crop. This is due, possibly, to the depth of the sand deposition and consequent lack of available moisture.

In townships 18 and 19, range 15, there is a level to gently rolling topography throughout which the soil is practically stone free. A portion of this area is irrigated and suffers from the presence of alkaline deposits. The area north of Patricia in township 20, ranges 12 and 13, is a medium to coarse sandy loam characterized by the presence of a slight amount of fine material which causes the soil to pack to a brick-like hardness along the roadway, but which under irrigation readily washes away and leaves a structureless loose soil. Although very low in water soluble salts, under irrigation the alkali accumulation in some of the low phases is quite heavy.

The sandy loams are, in general, soils of low agricultural value. Plant foods are low and their water holding capacity is low. This renders them less able to maintain growth over extended dry periods. However, since roots penetrate the lighter soils quite readily, the areas of sandy loam that have a water impervious layer fairly close to the surface offer some possibilities. Deep rooted perennials, such as certain varieties of alfalfa, are successful on these soils. Wind breaks set out in these soils have made remarkable growth.

FINE SANDY LOAM: These soils contain over 50 per cent of fine sand, and less than 20 per cent of clay. Such soils are, therefore, of fairly light texture. Generally the subsurface soils and subsoils are heavier than the

surface soils and subsoils are heavier than the surface soils, but this is not always the case.

The topography of the fine sandy loam areas varies from undulating to rolling. The color of the surface soil is generally dark brown, but it varies from dark brown to light brown, and the subsurface and subsoil vary from light brown to gray.

The fine sandy loams absorb water readily and retain it better than the fine sands, but not as well as the finer soils. The excess water percolates to a depth greater than that of ordinary plant roots, or until it encounters less pervious layers. Hence crops on fine sandy loam suffer more severely from drought than crops on heavier classes of soil, but less severely than crops on fine sands. Furthermore, the average fine sandy loam is more fertile than the average fine sand, being richer in nitrogen, phosphorus, potassium, calcium and magnesium, and for this reason, also, may be expected to produce better crops. Fine sandy loam areas will prove profitable where irrigation water can be applied, as they absorb water readily and retain it moderately well. Over-irrigation, on shallow lighter soils might cause accumulation if alkali salts. Since fine sandy loams are relatively loose and open, and drift rather easily when the organic matter content is reduced, a cropping system should be followed which would tend to maintain the soil's supply of fibre and fertility. Grasses such as brome and western rye and legumes such as sweet clover and alfalfa, should be grown at intervals by rotation.

LOAM: By definition the loams contain less than 20 percent clay, less than 50 percent silt, and less than 50 percent gravel and sand. The proportions of sand, silt, and clay are, therefore, such as to impart no predominating property of one constituent, and the soil is intermediate in character. In practice, of course, the loam areas are not altogether uniform, and this

is particularly true of the rolling and hilly phases.

Apart from the rolling and hilly phases, the topography of the loams is generally undulating or generally rolling, and in most places, the land is relatively free from stones and gravel.

The surface soils vary in color from very dark brown to brown, with dark brown predominating, and the subsurface and subsoils vary from brown to light gray, with gray predominating.

The loams absorb water readily and retain fairly large quantities of moisture that may be used by crops in periods of scanty rainfall, or carried over from season to season, and the average loam is relatively fertile. If surface soils are compared it will be observed that loam contains more nitrogen and organic matter than any other soil class except silt loam and clay, and contains about as much phosphorus as any other class except clay. Loams are, therefore, desirable from the standpoint of texture and fertility, and are adapted to a wide variety of crops.

Under irrigation, loams are probably as satisfactory as any other class of soil, especially where the subsoil does not differ greatly in texture from the surface soil. Such soils absorb and retain water readily, and may be cultivated when wet without injury to structure.

SILT LOAM: By definition the silt loams contain less than 20 per cent clay, and more than 50 per cent silt. The predominating constituent is silt, which naturally gives to the soil its characteristic property. The texture is therefore, fine, but only moderately sticky. The silt loam areas, like other areas, are not altogether uniform, and this is particularly true of the rolling and blow-out phases. Some patches of silt loam are lighter or heavier than the general class. The subsoils are usually heavier than the surface soils and could be classed, in most cases, as heavy silt loam, or silty clay loam. For the most part the subsoils are

fairly uniform in texture with high proportions of silt.

The surface soil varies in color from brown to very dark brown, with dark brown predominating, and the subsurface soils and subsoils vary from brown to light gray, with gray predominating. The organic matter layer varies in depth from about six inches to about one foot, the average depth being closer to the former figure than the latter.

The silt loams absorb water rather readily and retain fairly large quantities of moisture that may be used by crops in periods of scanty rainfall, or carried over from season to season. On the whole, there is probably no more desirable class of soil, from the stand point of resistance to drought, than a silt loam with a deep silty subsoil. Heavier soils absorb more water, but the rate of absorption is slower, run-off losses are greater, and plants cannot extract as much water from heavier soils, as it is held more tenaciously by the finer soil particles. Silt loams are desirable from the standpoint of fertility as well as texture, and are adapted to a wide variety of crops.

The area around Denhart is possibly the area of greatest erosion, the blow-out patches reach a depth as great as two feet and cover from 30 percent to 60 percent of the surface. These soils are solonetzic. The underlying Bearpaw shale is quite close to the surface in this area and exposures are found in many places. There is irrigation in some areas but there is a fair growth of grass on the virgin land, which forms the greater portion of the area, and so is of value as grazing land.

The largest silt loam blow-out area extends from Tilley to Duchess. Although profile development is more difficult to determine when irrigated it appears that there have been varying degrees of erosion. In places solonization has developed. Between Brooks and Duchess there is a very deep deposit of silt interspersed in places with layers of a sandy texture.

This area is very productive and solonized structures have softened and partly decomposed under the irrigation water.

An examination of the soil structure reveals the fact that the surface of the depression (blow-out) is usually fine and impervious in nature, and this rather impervious layer extends for some distance underneath the surface layer surrounding the depression, and may form a continuous surface layer between depressions. As a rule the surface soil between depressions is distinctively more open in texture, and when soil of this class are plowed and cultivated for some years the depressions are filled in, the finer and coarser layers are mixed up, and the resulting surface soil could properly be classed as silt loam. But because of the lack of grass in the depressed spots, and the rather undesirable nature of the subsurface layer, this class of soil, when first brought under cultivation, is not as fertile, nor as desirable in texture as ordinary silt loam. The surface soil is lower in nitrogen than any other class of soil except fine sand.

CLAY LOAM: By definition clay loam contains 20 to 30 percent of clay, and they are, therefore, somewhat sticky and rather heavy to work, and should not be cultivated when too wet, as this would injure the soil structure, at least temporarily. Some of the low-lying clay loam flats contain a good deal of salt, and for this reason are not productive as they would be otherwise. These heavier soils, however, can withstand more 'alkali' salt than the lighter soil classes, and clay loams are also fairly resistant to drought as they absorb and retain a good deal of moisture.

CLAY: Clay areas are found in the eastern parts of study area. They are small and consist of depressions or flats. By definition, any soil which contains over 30 percent of clay is called clay. Such soils must be

handled carefully and should not be worked when too wet, as this injures the soil texture. On account of the difficulty of working, only a small percentage of these soils have been cultivated.

The clay loam and clay in Gem and Rosemary area are irrigated and used for pasture, wheat and some sections for growing potatoes. The areas of the heavy are carefully prepared for crops and ideal sections of land are well drained for uniform irrigation and potato production.

MIXED AREAS: These areas usually consist of several classes of soil, so mixed together as to make it impossible to outline each class separately. Most of the mixed areas were formed as a result of the sorting action of water during glacial or more recent times.

RIVER BOTTOMS: These occupy chiefly the flood plains of the latter stages of the Bow River. The soil material varies greatly, and may be clay flats, or boulder heaps, or any of the intermediate admixtures, as well as patches of completely separated sands, silts, and gravels.

ERODED AREAS: The major portions of eroded areas are along the river channels, principally the Red Deer and its tributaries, in this area. In most of these eroded areas the underlying rock formations are exposed to the surface, consequently they are practically devoid of vegetation and so agriculturally are waste lands. There are thin seams of coal in some of the country rock that has been exposed by erosion which, although of low grade, can supply fuel needed by nearby residents.

ALKALI: Alkali lands usually occur in areas where the annual rainfall is less than twenty inches. It has generally appeared in depressions that receive the drainage from the surrounding soils and from which there is no drainage outlet. However, alkali may occur in level land that is not too well drained.

Most productive arid or semi-arid soils contain from .25 to .50 of one percent of water soluble salts. The soils of this study area are underlain by shale, principally of Bearpaw origin, which is one source of salts. The greatest concentration of alkali is often found at about the depth of annual percolation of rains. The tendency of irrigation frequently is to produce a concentration near the surface. The water dissolves the salts, and when evaporation begins, especially if excessive amounts of water have been applied, the water moves upward carrying the salts and leaving them at surface. The wilting point is higher and thus the moisture supply available for plant use is lower in these solonetzic soils.

CHAPTER II

HISTORICAL SETTING

Introduction:

According to W. A. McIntosh, "the settlement of a pioneer area is carried out by many individuals driven by many diverse motives; of these the economic is by no means dominant. Successful settlement, however, can only be achieved if an adequate income is possible - adequate in providing a reasonable standard of living, and adequate in comparison with alternative incomes. To insure adequate incomes, access to expanding markets is essential, and the land must be suited to the production of marketable commodoties. Land can be deemed suitable only if there have been developed arts of utilizing the particular types of land available. The land must be sufficient in quantity to support a volume of production and density of population capable of maintaining the economic, social and governmental services which are deemed essential. Where these conditions are not fulfilled settlement fails and is succeeded by poverty, abandonment and deterioration."[1] This is an appropriate summary of the background of settlement in the irrigated parts of South eastern Alberta. The Canadian Pacific Railway Company's Eastern Irrigation Block provides an example of what has occurred when land naturally suitable for grazing and precarious for dry farming in most area, is supplied with irrigation facilities and colonized for irrigation farming.

In securing suitable settlers to farm the lands, irrigation became the most important incentive in the Eastern Irrigation District. The first

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[1] W. A. McIntosh, Prairie Settlement: The Geographical Setting, Vol. I of Canadian Frontiers Settlement, edited by W. A. McIntosh and W. L. G. Joerg, 9 Vols., Toronto, 1934-40, p. xiii.

attempt at irrigation in Southern Alberta, was undertaken by John Glen in 1879 on a 15-acre tract of land at Fish Creek, 8 miles south of Calgary, on Section 3, Township 23, Range 1, west of the 5th Meridian.[2] Shortly afterwards a number of ranchers began irrigating other small parcels of land to provide sure source of food and feed.

In 1887, Mormon immigrants came to settle in Alberta from the United States of America. They came from an area which had been for the previous forty years almost completely dependent on the production of irrigated lands. The enthusiasm of these irrigation settlers helped to convince both the Dominion Government and railway officials of the possibilities of irrigation development. It was their labour that helped to construct the original works of the Alberta Railway and Irrigation Company and their skill which utilized the water as soon as that company began deliveries of water in 1901.[3]

In 1894 the North West Irrigation Act was passed by the Parliament of Canada. Col. J. S. Dennis, as Chief Inspector of Surveys in the Department of the Interior, was principally responsible for drafting the North West Irrigation Act. The basic principles of the Act have never been altered, and may be summarized as follows:[4]

1. The ownership of all surface waters is vested in the Crown and these waters, or the right to their use cannot become private property

2. The use of water is regulated by licenses from the Crown which are subject to cancellation for non-use or mis-use.

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[2]C. C. Spence, B. H. Kristjanson, and J. L. Anderson, Farming in the Irrigation Districts of Alberta, Technical Bull. No. 61, Dominion of Canada, Dept. of Agriculture, Ottawa, Nov. 1947, p. 7.

[3]T. H. Hogg, Royal Commission on the South Saskatchewan River Project, Ottawa, 1952, p. 147.

[4]C.S. Burchill, Development of Irrigation in Alberta - An Historical Survey, Canada Dept. of Agriculture, Economic Division, Edmonton, 1949, p. 1.

This thesis is a study of the Eastern Irrigation District in particular and detailed discussion on the District will follow in later chapters. A general survey of the development of irrigation in the Province of Alberta is done to provide the background, since 1879 when the first private irrigation project started in Alberta.

PHASES OF DEVELOPMENT:[5]

The development of irrigation in this Province has been an uneven but continual process since the beginning of this century. There seems to have been three distinct phases of irrigation development in each of which the intentions of those establishing the projects were quite different. The first of these might be called the commercial phase, which lasted from about 1900 to 1920, in which there was corporate activity in establishing irrigation. The second period could be termed the community enterprise phase, in which farmer-owned and operated districts were formed under the supervision and guidance of the government. Government participated in the irrigation projects passively but later on was gradually drawn into arrangements for operation as the guarantor of bonds. The last stage began about the end of the Second World War and is still continuing. In this period both the Federal and Provincial Governments have accepted the responsibility for the establishment of schemes and for the maintenance of certain major structures. The Federal Government has been active through P.F.R.A. since 1936. The existing irrigation schemes can be considered as they have developed in each of these three phases. It is important to note that some of the irrigation projects have gone through several of these phases while others have not. The Eastern Irrigation District has gone through the first and second phases but has been affected less by the third

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[5] Ibid., pp. 2-7.

phase than most other irrigation developments (see Fig. 1 for locations).

(a) The Commercial Phase:

Prior to World War I most of the larger irrigation developments in Alberta were undertaken by joint stock companies, operating as commercial enterprises in the hope of profit. Large land grants were made to the railways in Western Canada to provide finances for railroad construction. The importance of these lands to the railroads was two-fold. In the early stages they were expected to provide capital through their sales, later they were to provide operating revenue. Investments on this land by the Railway Companies increased its sale value, brought more settlers and more income through sale of transportation services. The areas changed from extensive farming to intensive farming with more prosperous communities.

In 1892 the Alberta Railway and Coal Company arranged an exchange of land through the Honourable Clifford Sifton, Minister of the Interior, and accepted a block of potentially irrigable acreage near Lethbridge in return for part of the original land grant to the Company from the Federal Government. This land was sold to prospective settlers later through a land holding subsidiary. In 1898 the Alberta Irrigation Company became the Northwest Irrigation Company and in 1904 it was amalgamated with the Alberta Railway and Coal Company to form the Alberta Railway and Irrigation Company. The assets of this Company were acquired in 1912 by Canadian Pacific who operated the irrigation side of the enterprise until 1946 when the ownership and operation was transferred to the Government of Alberta.[6]

The Canadian Northwest Irrigation Company paid $2.00 an acre for the land between Lethbridge and Medicine Hat, to the parent Companies and

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[6]W. R. Hanson, Report of the Irrigation Study Committee to the Government of Alberta, Calgary, Sept. 19, 1958, p. 1.

resold a tract at $3.00 an acre as irrigable land to Mormon settlers in the Magrath and Stirling area.[7] The irrigation works were constructed largely by the labor of the settlers themselves, whose wages were paid one-half in land at the above valuation.

The second major irrigation enterprise was undertaken by the Canadian Pacific Railway Company. In 1903 the Company accepted from the Dominion Government an enormous tract of land between Calgary and Medicine Hat as a settlement of its outstanding grants claim. It was approximately 2,898,000 acres to which some 102,000 acres were added through purchase from the Hudson's Bay Company by the Canadian Pacific Railway Company.[8] This land had originally been classified as "not of fair average quality for settlement" and had been open for grazing purposes only. The C.P.R. officials were influenced by the claims of the Federal engineers about the economic feasibility of irrigating the area.[9] With irrigation, they anticipated that the C.P.R. would eventually profit from a considerable traffic for the railway. Construction of irrigation works began in 1904 and simultaneously a campaign was launched to attract settlers to the region.

For convenience in administration and construction, the Company divided the irrigation block into three sections, Eastern, Central and Western, each comprising about 1,000,000 acres.[10] It was the original hope of the Company officials that approximately half of the total area

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[7] Ibid., p. 2.

[8] C.S. Burchill, Ibid., p. 3.

[9] T. H. Hogg, Ibid., p. 140.

[10] J. S. Dennis to Charles Drinkwater, Secretary, C.P.R., August 15, 1905, File No. 336, D.N.R. These C.P.R. Co. files are presently in the possession of the E.I.D. in Brooks.

of the block, or 1,500,000 acres would prove to be irrigable. The Company planned, however, to complete the Western Section of the block before proceeding to the construction of the remaining sections. By 1905 the main canal and secondary canals were completed. According to the original estimates of the Company about 300,000 acres in the Western Section were irrigable.[11]

As soon as construction of the Western Section was underway, the officials gave their attention to the question of the temporary use to be made of the land in the Central and Eastern Sections, pending the extension of the canal system in these areas. This region constituted one of the last major refuges of the range cattle industry in Canada. In 1903 there were within the confines of the irrigation block 152 ranches leased by the Department of the Interior for grazing purposes.[12] Such leases, covering both odd- and even-numbered sections, were in great demand by the cattlemen, the more so in view of the fact that the Government land in other parts of the West was subject to homestead entry.[13] When the Canadian Pacific agreed to accept the land in the irrigation block, it was naturally besieged by the ranchers who desired lease from the company. The Central Section mainly remained a ranching area.

In 1909 the Company started construction of its Eastern Section Project and by 1914, 3,000 miles of ditches were completed. In June, 1914, the first irrigation water, diverted by the dam on the Bow River, at Bassano, was sent to Gem for use by the new settlers in the Eastern Section.

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[11] Ibid.

[12] Ibid., File No. 441, D.N.R.

[13] J. B. Hedges, Building the Canadian West, The Macmillan Company, New York, 1939, p. 176

The third corporate venture in the establishment of irrigation was undertaken by the Canada Land and Irrigation Company. This Company was solely concerned with the commercial possibilities that were afforded in irrigation development. The economic basis was the anticipated investment return and nothing else.

In 1906 the Robins Irrigation Company made an agreement with the Dominion Government to purchase 380,000 acres of potentially irrigable land to the west of Medicine Hat in what is now the Bow River Project area.[14] The Company made a few preliminary surveys for canal location and with the consent of the Government transferred their interest to the Southern Alberta land Company. Further surveys by this Company revealed that a considerable portion of the tract they had purchased could not be irrigated so an exchange was arranged.

The engineering and financial difficulties which made the Company's problem so complex, created considerable scepticism as to its ability to carry the project to a successful conclusion. Reorganization in 1917, which amalgamated it with the Canadian Wheat Land Company to produce the Canada Land and Irrigation Company, eased the financial strain. The new Company completed the main canals in 1918 and in 1920 the first land was irrigated.

From 1919 to 1950, the project operated on a subsistence basis and in 1950 the assets of the Canada Land and Irrigation Company were purchased by the Federal Government.

Before the passing of the Irrigation District Act in 1915 in Alberta, there were four main projects developed in the province all completely supported by the corporate interests. Aside from land grants, there were no other financial grants provided by the government to these

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[14]T. H. Hogg, Ibid., p. 142.

companies. These were the Alberta Railway and Irrigation Company, the C.P.R. West Block, the C.P.R. East Block, and the Canada Land and Irrigation Company. The Federal Government created the Province of Alberta in 1905 and the Department of the Interior partially passed control of lands and connected projects to the Province, though the full control was not transferred until 1930. With the passing of the Irrigation District Act (Alberta) in 1915 irrigation entered the second phase of development in the Province of Alberta.

(b) The Community Enterprise Phase:

Irrigation districts were first authorized under an Ordinance of the North West Territories of 1894, which was repeatedly amended by the territorial legislature and was finally repealed by the Alberta Legislature in 1915 when the present Irrigation District Act was substituted for the earlier measure. The irrigation districts were provided identical powers to those granted to Municipal Districts and were recognized by law, as being part of the Local Government but not in all respects.

The financing of these Districts was achieved through the acceptance of the bonds of each of the three districts by the C.P.R. through A.R. and I. which was a wholly owned subsidiary.[15] Until the change in the role of the Provincial Government, the four differently governed districts were receiving water from the works constructed by the A.R. and I. The comparative areas of these districts are shown in the following Table VII.

With the formation of the Lethbridge Northern Irrigation Distict in October 1919, the Provincial Government involvement in irrigation projects increased, as Government guaranteed bonds were sold to meet the costs of

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[15]W. R. Hanson, Ibid., p. 2.

construction and repairs in 1923. Due to numerous reasons, this district had to be established through very substantial assistance from the Provincial Government in refinancing the bonds and writing off four-fifths of the costs of constructing and establishing the project. The district operated under an official trustee and the action of the government was more that of a responsible parent to a difficult child than that of an active investor in the development of irrigation.[16]

TABLE VII - IRRIGATION DISTRICTS RECEIVING WATER FROM THE WORKS OF THE ALBERTA RAILWAY AND IRRIGATION COMPANY (1940)

a. A. R. and I Project - Lethbridge and Coaldale	84,000 acres
b. Magrath Irrigation District	7,000 acres
c. Raymond Irrigation District	15,000 acres
d. Taber Irrigation District	21,500 acres
	127,500 acres

Source: V. Meek, Report of the St. Mary and Milk River Development Committee, Ottawa, 1942, p. 37.

During this period the C.P.R. was finding its Western and Eastern Irrigation Blocks quite a drain on its resources and increasing handicaps in its operation. The C.P.R. was unable to collect the costs of irrigation works from its settlers. By 1935, the C.P.R. had received only a sum of $550,000 for the sale of land in the Eastern Block out of a total estimated sale value of $3,000,000. The Eastern Block was incorporated as the Eastern Irrigation District by the Alberta Government in 1935 and all the irrigation works, land contracts and unsold lands in the district, together with a capital reserve of $300,000 for replacing large structures, were transferred to the farmers, to be operated under a board of trustees as laid down in the Irrigation Districts Act. This district has been

[16]Ibid., p. 3.

operated successfuly since without using the capital sum given to it by the C.P.R. Company.

In 1937 Irrigation was extended into the Rolling Hills area in collaboration with the P.F.R.A. The E.I.D. in exchange for a grant of $45,000 provided this land on an Agreement for Sale basis for only $8.00 per irrigation acre and spent $301,000 on canals and other works that were required.

The C.P.R. operated the Western Irrigation Block until 1946 and then transferred it to the farmers with $400,000 under a similar arrangement as agreed upon in the formation of the E.I.D.

Four small Irrigation Districts were set up during the inter-war period - the United Irrigation District in 1921, New West Irrigation District in 1921, the Mountain View Irrigation District in 1923, and the Leavitt Irrigation District was authorized in 1936. The Aetna Irrigation District was formed after the Second World War in 1945. The undertaking of this District was on the margin of the second phase of district formation and third phase of Government development.

Financing of the Mountain View Irrigation District showed a departure from previous practices of the Provincial Government. The members of the district agreed to provide labor and materials in the proportion of their irrigable acreage thereby avoiding an encumbrance on the title of their irrigable land. In 1937, P.F.R.A. gave a grant of $3,000 to widen the main canal. The water users have constructed and maintained their own system. The Leavitt Irrigation District was also constructed in a similar fashion. In the districts of Mountain View and Leavitt water was used mainly for stock watering and production of feed.

The United Irrigation District attempted to be self-financing but

was unsuccessful as shown by the findings of the Ewing Commission. The Provincial Government assumed all responsibility for debentures and the farmers were only required to pay an average of $7.00 per acre for all the water rights. This was deemed within the capacity of the farmer if he wanted to own his land.[17]

The beginning of the Second World War had a very drastic effect on the operation of the irrigation districts as regards the meeting of their own capital and operation costs. Small irrigation districts, well settled and with conditions favourable to specialty crops, having easy access to water had been successful without much Government help. But, the large projects such as C.P.R. Blocks, and Lethbridge Northern were not because there was little demand for extensive areas of irrigated land. The Ewing Commission, set up in 1936 by the Provincial Government, came to the conclusion that if large areas were to be irrigated the capital would have to be supplied by the Provincial Government. The Meek Report, published in 1942, set the stage for the new era of Government involvement in irrigation development in Canada.

(c) The Third Phase:

The Meek Report, 1942 stated, "That Canada should construct at an early date the necessary irrigation works to protect by beneficial use of its share of the St. Mary and Milk Rivers,"[18] before such time as the U.S.A. began to utilize them fully. This urgency was a consequence of the need to establish right to the Canadian share of international waters. The

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[17]A. F. Ewing, Report of Commission appointed in 1936 to Inqure into Various Phases of Irrigation Development in Alberta, Edmonton, 1937, p. 14.

[18]V. Meek, Report of the St. Mary and Milk River Development Committee, Ottawa, 1942. p. 2.

St. Mary and Milk River Development is really an extensive enlargement of the old A.R. and I. Company Project. Later on, it was found that more land could be irrigated than could be supplied with water from these two rivers, and diversions of water from the Belly and Waterton Rivers were included in the plans. Structures for both have now been completed.

It was believed that the costs on the S.M.R.D. would work out at about 55 per cent to the Federal Government and 45 per cent to the Provincial Government. Some fraction of the outlay of Provincial Government is being recovered from the owners of the land through other revenues and from new settlers by charging the farmers a water right of $10.00 an acre.[19]

The C.P.R., which owned the A.R. and I. schemes, agreed to transfer the works along with $100,000 in cash to the Alberta Government. So in 1946, the C.P.R. got entirely out of irrigation development and operation by transferring the Western Irrigation Block to farmers. This change brought the Federal and Provincial Governments, and the water users to the forefront for the future development of irrigation in Canadian Provinces.

The last remaining Company operation in the province was the Canadian Land and Irrigation Project. The P.F.R.A. organization arranged an outright purchase of this scheme in 1950 and proceeded to set about an expansion known as the Bow River Development. Both Federal and Provincial Governments agreed on June 23, 1953, to develop the irrigation projects in this province but P.F.R.A. remained as the owner and operator of a substantial part of development. The Government of Alberta formed a Crown Corporation to operate the Bow River Development, West Block, by

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[19]W. R. Hanson, Ibid., p. 5.

passing an act of legislature in 1955.

With these developments in the post-war period the Government of Canada through construction and reconstruction of major works, and the Government of Alberta through construction of local distribution systems, the administration, and the organization for colonization, settlement and operation have both become substantially involved in irrigation schemes (see Table VIII).

The detailed study of each irrigation district is not within the scope of this thesis. The following principles may be applied fully for some and partially for other districts practicing irrigation in the Province of Alberta.[20]

(1) Where dry farming is at all possible, settlers will welcome irrigation during a dry cycle; they will not use the irrigation facilities provided, and will evade responsibility for paying for these facilities if opportunity for non-use or for evasion exists.

(2) Unless the settlers are skilled irrigators, they will not reduce their land holdings to optimum size, nor will they follow sound irrigation practices, unless compelled to do so. Where such compulsion is applied honestly and impartially it will be accepted with fairly good grace, and will not result either in general abandonment of the District nor in serious disaffection.

(3) No District has a reasonable prospect of success until land payments are brought into harmony with the productivity of the area.

(4) If settlers are to survive the period of development, they must either possess considerable working capital or be able to obtain it at low rates of interest.

(5) A District may survive, and pay at least part of its operating and maintenance costs, but it cannot become prosperous or make any worthwhile contribution toward its capital costs, until markets are developed for specialized, high value crops - sugar beet, potatoes, different kinds of vegetables, alfalfa, variety of seeds, etc., in the production of which irrigated land has a marked competitive advantage over non-irrigated lands.

The Eastern Section was settled by the C.P.R. Company largely on

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[20] C. S. Burchill, Ibid., p. 15.

TABLE VIII

IRRIGATION EXTENT AND LOCATION IN ALBERTA - 1967

Source of Supply	Project	Closest Centre	Constructed by	Year Dev.	Operated by	Approx. Acres Under Irrig.	Total
Bow River	Bow River Proj.	Vauxhall	Can. Land & Irrig.	1920	P.F.R.A.	63,000	
	(Central Block)	Hays	P.F.R.A.	1955	P.F.R.A.	30,000	
	(Blackfoot Reserve)				P.F.R.A.	5,000	
	Bow River Dev. (West Block)	Enchant	Alberta	1958	Alberta	25,000	
	Western Irrig. District	Strathmore	C.P.R.	1911	Farmers	42,000	
	Eastern Irrig. District	Brooks	C.P.R.	1914	Farmers	200,000	365,000
Waterton River	United Irrig. District	Glenwood	Farmers	1924	Farmers	34,000	
Belly River	Mountain View Irrig.Dist.	Mountain View	Farmers	1932	Farmers	3,700	
	Leavitt Irrig. District	Cardston	Farmers	1943	Farmers	4,600	
	Aetna Irrig. District	Cardston	Farmers	1943	Farmers	8,300	50,600
St. Mary River	S.M.R.D. West Section	Lethbridge	A.R. & I.	1901-20	Alberta	82,000	
	Magrath Dist.	Magrath	Farmers	1926	Farmers	7,500	
	Raymond Dist.	Raymond	Farmers	1925	Farmers	19,000	
	Taber Irrig. Dist.	Taber	Prov. Gov.	1950	Farmers	40,000	
	S.M.R.D. East Section	Bow Island	Prov. Gov. & P.F.R.A.	1955	Alberta	122,000	270,500
Old Man River	L.N.I.D.	Picture Butte	Farmers	1923	Farmers	96,100	
	S. Macleod Dist.	Macleod		1948		3,000	99,100
Other Sources	Ross Creek Irrig. Dist.	Medicine Hat	P.F.R.A.	1949	Farmers	2,100	
	Berry Creek Irrig. Dist.	Wardlow	P.F.R.A.	1938		3,000	
	Little Bow	High River	Farmers			200	5,300
	In addition to the above there are about 650 private licensed irrigation schemes with a total area of approximately						75,000
	Total number of irrigated acres in Alberta						865,500

Source: C. J. McAndrews, Alberta's Experience in Irrigation, (Manuscript) Alberta Dept. of Agriculture, Colonization Branch, Lethbridge, 1967, p.2.

the same lines its Western and Central Sections were settled. The type of settlers attracted was very much the same. The methods of administration adopted by the company and the programs of educating the settlers for irrigation farming were also identical. There were, however, two important differences in the total set up of the Eastern Section and other sections settled under the directions of the company.[21]

(1) The settlers in the Eastern Section were required to pay an annual rate of $1.25 an acre instead of only 50 cents an acre as in the Western Section, and an increase of 150 per cent in annual water rates was a considerable item in farmer's budget.

(2) The climatic conditions in the Eastern Section made dry farming a hopeless proposition.

The alternative in the Eastern Section was not between irrigation and dry farming as in the Western Section but it was a choice between the utilization of low grade grazing land to support small numbers of livestock and the use of the same land partly for irrigation farming.

These two alternatives were open to settlers who decided to remain in the Eastern Section. There was also a third course open to settlers in this project that they could abandon the attempt to farm in this Section altogether and go elsewhere. This course was followed by a very large number of settlers who bought land in the Section. There was a big influx of settlers after the First World War and by the summer of 1921, 1,149 farm units were occupied.[22] The exodus began almost immediately. By 1924, 407 farm units were abandoned by the original purchasers.[23] The company adopted

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[21]C. S. Burchill, Ibid., p. 17.

[22]A. G. Griffin, Eastern Section, Engineering Branch, Annual Report, 1922, C.P.R. Company, D.N.R., Brooks, p. 28.

[23]Ibid., 1925, p. 25.

lenient collection policies, reclassification of land on terms more favourable to the farmers, and a sizeable reduction in the purchase price of the land. But all these efforts failed to hold the farmers. In spite of all this, new settlers could still be attracted because of vigorous sales campaigns, but none of this could keep the settler on the land. Between 1927 and 1930, 524 new sales contracts were signed but the number of water users increased by only 123.[24]

The Eastern Section had no difficulty in persuading its settlers to use irrigation water because of soil types and climatic conditions. But it could not persuade them to practice irrigation farming. The chief discouraging factor was undoubtedly the high price charged for irrigated land. Even in 1927, when prices were reduced to approximately $35.00 an acre, prospects remained very bleak.[25] Irrigation land can be made productive only by a heavy expenditure of labour, in levelling land, erection of fences and building and stocking farms with good quality livestock. Few immigrants had any capital beyond the small amount paid as a down payment on land; many lacked even this, and had no equity in their farms whatever. Yet all permanent improvements carried out by the tenant such as levelling, fencing and building, became the property of the landlord. The tenant or purchaser who made such improvements could only become their owner when his contract was paid out within thirty-five years, if he lived that long. There was not much incentive for improvement. Until improvement had been undertaken on a very considerable scale, productivity must remain low.

In conclusion it seems quite hard to generalize that irrigation has

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[24] C. S. Burchill, Ibid., p. 17.

[25] Ibid., p. 18.

been a great success or failure in Southern Alberta. It is obvious that so long as the land remains abundant on the Prairies, irrigation will not expand greatly. A number of areas in southern Alberta are most suitable for irrigation farming because of the climatic and edaphic factors. The significant results of the last eighty-five years of irrigation farming show that irrigation projects would be failures without public ownership of all on-stream headworks and government responsibility for operation and maintenance. After a long time, the government may charge, if it deemed fit, all multi-purpose users of water in proportion to benefits received. It might also be suggested that the government should find out some method of subsidization of the existing irrigation projects for a long-range success. The cooperative efforts of the prospective irrigators, as in the Mountain View Irrigation District, could be useful and effective. With the existing conditions, irrigation has a future in Alberta.

CHAPTER III

LAND USE CHANGES 1903-1934

Introduction of Irrigation:

In the summer of 1910 the C.P.R. Company started the construction on its Eastern Section Project which comprised some 440,000 irrigable acres out of a total area of about 1,500,000 acres. The town of Brooks on the main C.P.R. line between Medicine Hat and Calgary became the operating headquarters, presumably because it is approximately in the centre of the tract (see Fig. 1).

Water was diverted from the Bow River at a point known as Horseshoe Bend (twp. 20 rg. 19) in May, 1914. The dam across the river at this point is one of the features of the project, and consists of an Ambursen hollow type reinforced concrete structure 55 feet in height and 720 feet long, with an earth fill on the west side 7,200 feet long.[1] The main canal at the intake has a capacity of 3,809 cubic feet per second. The dam has a live storage capacity of 14,000 acre feet of water, which equals 203,280,000 cubic feet or approximately 4,000,000 tons of water. The total cost of building Bassano Dam was $1,500,000 (see Fig. 6). The Brooks aqueduct is next in magnitude to the Bassano Dam. It is built entirely of reinforced concrete. It is two miles in length, twenty-one feet four inches wide at top-inside, ten feet two inches deep, with a maximum height above the ground of fifty-five feet, and presents a very imposing appearance.[2] The discharge capacity of the aqueduct is 900 cubic feet per second. The eastern end is

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[1] Report on Irrigation for the year 1914, Dept. of Interior, Dominion of Canada, Part VII, 1914, p. 112.

[2] Ibid.

FIG. 6 - THE GATES OF THE MAIN CANAL FROM THE RESERVOIR BEHIND BASSANO DAM - COMPLETED IN 1915 BY THE C.P.R. COMPANY

four to five feet lower than the western end, causing a grade for the water to flow. It was completed late in the summer of 1914 and the first water ran through in September (see Fig. 8). The aggregate length of canals and distributaries completed was 2,400 miles. The total cost of the irrigation project to the C.P.R. Company was $13,000,000.[3]

The irrigation department of the company planned for canals and ditches in the Eastern Section in 1912 for a total possible area which could ultimately be irrigated. The total possible area suitable for irrigation, according to company estimates and the Department of Interior surveys, was 440,000 acres.[4] All of the areas depicted in Figure 7 were suitable for irrigation according to the Company's irrigation branch. The non-shaded areas were unsuitable for irrigation and leased to the settlers for grazing. Great care was not taken in the classification of the irrigable land and a revision by the Department of Interior was necessary. The irrigable areas in the Section were reclassified in 1934 and the area considered irrigable was reduced from 440,000 acres to 250,000 acres. It was a drop of about 43 percent, which surely justified the abandoning of many farms by the settlers in 1926-27. Because of the greater cost of operation in this section the company felt obliged to charge an annual rental of $1.25 per acre. There could be some other reasons also for this abandonment but as a result of inaccurate classification of irrigable land, the settlers paid excessive annual rentals from 1912 to 1934. It was a drain on the limited resources of the settlers. According to the Annual Reports of the C.P.R. Company in 1927, 408 farms had been abandoned and

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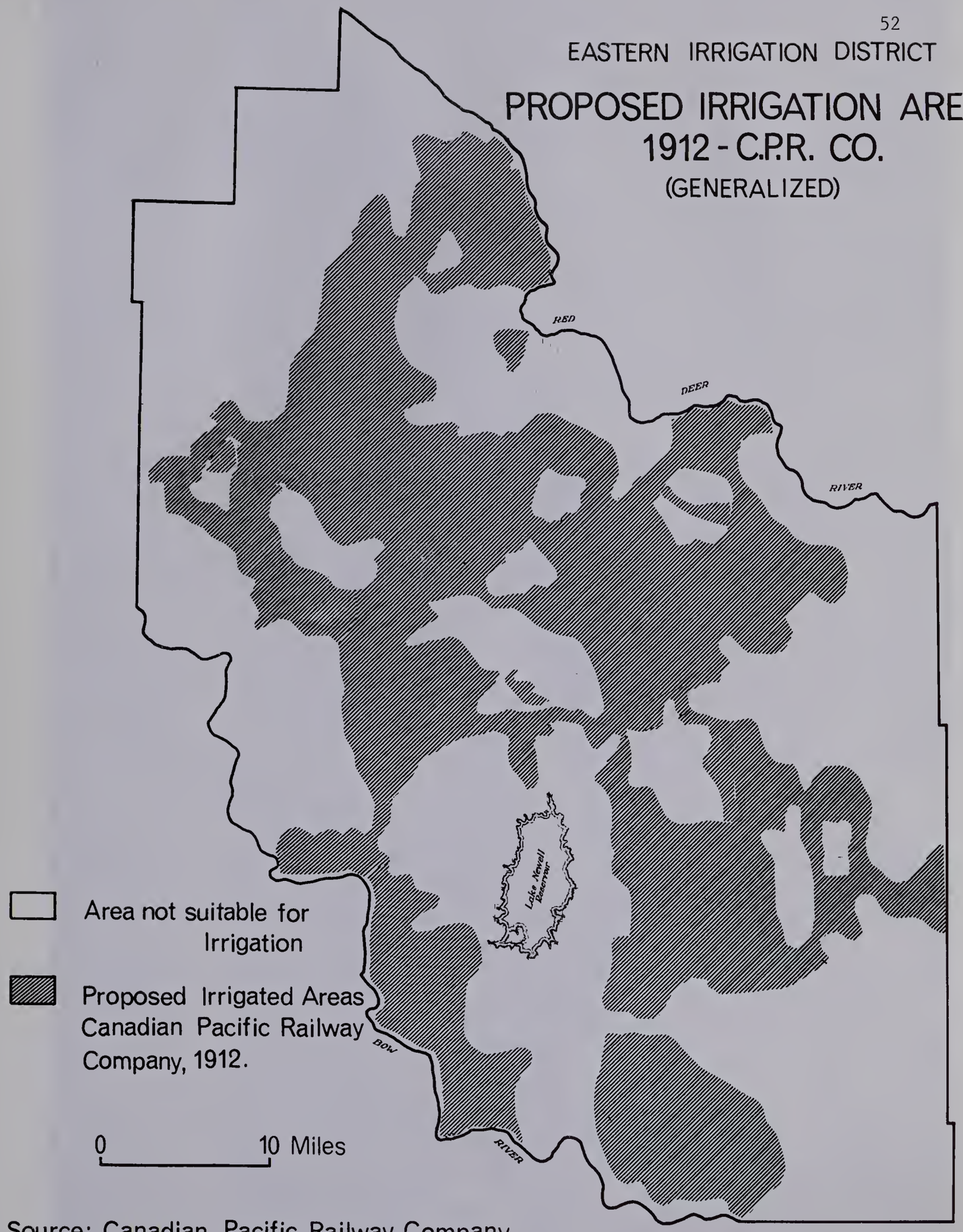
[3]E. F. Drake, Report on Irrigation Survey and Inspection, Dept. of Interior, Canada, Irrigation Branch, Ottawa, 1915, p. 72.

[4]Ibid.

EASTERN IRRIGATION DISTRICT

PROPOSED IRRIGATION AREAS 1912 - C.P.R. CO.

(GENERALIZED)



Source: Canadian Pacific Railway Company, Irrigation Dept., 1912.

Fig. 7

FIG 8 - THE BROOKS AQUEDUCT

113 were in abeyance and it showed a cancellation of 15,598 acres by the contract holders.[5]

SETTLEMENT OF THE AREA:

By 1911, this area had a population of 1,878 and the Company sent its representatives to the U.S.A., Europe and Eastern Canada searching for a better type of settlers for this newly opened irrigated area. A tremendous publicity campaign was launched in all the above mentioned parts of the western world. It is quite interesting to quote the following from one such advertisement in the daily papers:

> "Buy an Irrigation farm from the C.P.R. Because: Irrigation makes the farmer independent of rainfall, and insures good crops, not occasionally, but every year.
>
> Irrigation makes possible the successful culture of Alfalfa, the king of fodders, which insures best returns in dairying and mixed farming. Irrigation means intensive farming and close settlement with all advantages of a densely populated agricultural community.
>
> Irrigation in the C.P.R. Irrigation Block is no longer an experiment, the year 1914 having demonstrated its success wherever intelligently applied.
>
> You can buy irrigated land from the C.P.R. at prices ranging from $35 to $75 per acre, with twenty years to pay and the privilege of a loan of $2,000 for improvements (6 percent interest);
>
> No principal payments at the end of first or second years and no water rentals for first year. Assistance is also given in supplying stock in approved instances. This is the most liberal offer of irrigated farm land on record. Get full particulars from:
>
> Department of Natural Resources
> Canadian Pacific Railway
> Calgary,"[6]

It is one example of the campaign carried out in Canada. Similar steps were taken in different campaign areas by the Company with the full

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[5]A. Griffin, Eastern Section (Operation and Maintenance) Annual Report, 1927, C.P.R. Company, D.N.R., Calgary, 1927, p. 22.

[6]The Brooks Bulletin, Vol. 5, January 2, 1915.

cooperation of the Dominion Government of Canada.

For the season of 1914 the Department of Natural Resources devoted particular attention to the settlement of the ready-made farm colonies available in this section and the successful establishment of twenty-three Colorado families in the Bassano Colony seemed to provide an auspicious beginning. It gave an inspiration to the C.P.R.Company officials to establish another colony from the States at Brooks. At Scotts Bluff in Nebraska, there was a community of German-Russians engaged in the cultivation of sugar beets on rented land. Although very poor, they were hard working and experienced in irrigation, which made them excellent prospects for the C.P.R. Company. Because of their poverty, however, they could not be moved except by dint of great effort, and it was out of the question for them to purchase irrigable land even under the liberal colonization policy of the railway Company, with its loan for improvements and twenty year period for payment. The Company officials felt it justified in making an exception to the accustomed policy governing the sale and settlement of the Company's land.

Arrangements were made by which these settlers, after paying one-twentieth of the purchase price at the time of application, should be excused from all further payments for three years, at which time one-seventeenth of the unpaid balance would be due. Water rental was to be remitted for two and one-half years. The Company would erect a house and barn on each farm, supply materials for other structures to be built by the farmer himself; it would dig a well and supply posts and wire for the fencing to be done by the settler himself.[7] The farmers argued that in

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[7]Thornton to Cameron, November 6, 1915, File No. 764, D.N.R. (This and other entries of footnotes 9 to 13 are found in the files of the C.P.R. Co., which are presently in possession of the E.I.D., Brooks.)

their existing location they could somehow get by, and were doing reasonably well on a rental basis. The cost of moving to Canada, they averred would be an absolute loss to them. Though the Company offered to credit this amount expended in freight and transportation on the cost of the land, yet these German-Russian farmers of Nebraska were not induced to come to the Eastern Irrigation Section for some time.

The officials of the Company at Calgary were unanimous on the necessity of establishing a colony in the Brooks district as a nucleus for further settlement in the area, and the belief was equally unanimous among Company representatives in the United States that these people could not be moved as ordinary American settlers, but must be transplanted in a body, the poorest along with the more well-to-do.[8] To meet this particular situation, therefore, Col. J. S. Dennis, Head of the Natural Resources Department, approved the plan to advance from $500 to $1,000 per family to the poorer members of the Colony to enable them to purchase stock, machinery, and other equipment.[9] For these people, then, the Company combined the ready-made farm with a loan for livestock. This clinched the bargain and in February, 1916, the vanguard of the colony arrived at Brooks, where T. O. F. Herzer was temporarily stationed to help them in getting started.[10]

Among those in England whose interest was aroused by the announcement of the ready-made farm program was the Duke of Sutherland. In the summer of 1910 the Duke made known to the Calgary Office his desire to purchase a sufficient area of land in close proximity to the main line of the Canadian

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[8]J. B. Hedges, Building the Canadian West, The Macmillan Company, New York, 1939, p. 298.

[9]Cameron to Naismith, November 26, 1915, File No. 764, D.N.R.

[10]Dennis to Naismith, December 1, 1915, Ibid.

Pacific in the irrigation block, to make 12 farms, varying in size from 80 to 120 acres. He desired to erect a set of plain buildings on each farm, with a more pretentious house on a central farm. He wanted to colonize the farms with the married sons of some of the tenants on his estates in Scotland, reserving the central farm for himself and the Duchess, who planned to spend a few weeks each summer on the land, which would be farmed under the Duke's supervision.[11]

The Company sold to the Duke two sections of land just north of Brooks in the eastern section of the block, the price being $35.00 per acre for irrigable and $15.00 per acre for non-irrigable land. The Company agreed to construct necessary buildings on the twelve farms, expending $2,300 on the small ones and $8,000 to $10,000 on the central farms, the Duke paying cash for the improvements. As in the case of the Company's own ready made farms, a portion of the land on each farm was to be seeded to crop in advance of the arrival of the settlers, who were to be selected by the Duke himself from his own tenants.[12] Because of this, Company launched one of the most curious ventures in the colonization of British settlers in Canadian West. The Canadian Pacific prepared a booklet entitled "The Duke of Sutherland's Alberta Lands: Brooks and Clyde, Alberta", which was widely circulated in England not for the recruitment of settlers for the colony, but by way of informing the British public concerning the opportunities offered by Alberta to British investors.[13]

The area around Scandia and Bow Slope was settled by Swedish immi-

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[11]Peterson to Dennis, July 4, 1910, File No. 377, D.N.R.

[12]Peterson to Dennis, November 22, 1910, Ibid.

[13]Copy of the Booklet is in File No. 377, D.N.R.

grants during World War I. In 1915, a number of Coloradans, experienced in irrigation, settled in the Gem area.

By 1915 there were sixty farmers who occupied the irrigable land and sixteen took up new irrigable land in 1915 in the Eastern Section.[14] These sixteen new settlers were were distributed as follows:

Bassano colony 12, Rosemary 3 and Duchess 1. New grain elevators were also built at Rosemary and Duchess on the Bassano-Empress railway line. In the Annual Report of 1915, the Superintendent of Operations and Maintenance of this irrigation block reported the water deliveries which were made during that year to the settlers. These are as follows:[15]

TABLE IX - NUMBER OF WATER USERS AND WATER DELIVERIES IN THE E.I.D., 1915

District	No. of Water Users	No. of Water Deliveries
Bassano Colony	38	50
Bassano	5	10
Rosemary	5	12
Duchess	1	2
Cassils	1	2
Brooks	1	4
Sutherland	11	16
Tilley	3	2
Total	65	98

Source: A. Griffin, Eastern Section (Operation and Maintenance) Annual Report, 1915, C.P.R. Co., D.N.R., Calgary, 1915, p. 17.

The above chart provides information about the number of water-users within one year of the start of irrigation in the Eastern section. It also

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[14] A. Griffin, Ibid., 1915, p. 17.

[15] Ibid.

gives an idea of settlement development and the frequency of water utilization for crops by the new settlers.

Within one year of irrigation operation in the Section, there were significant changes in the land use patterns. Three types of land use developed as a result of the introduction of irrigation were unimproved pasture, irrigated crops and reservation operations. (see Fig. 9 and overlay for areal identification). Irrigation farming started in vicinities of Bassano, Gem, Brooks and Tilley. The company operated reservations in the Section for demonstrating irrigation farming to the new settlers. In spite of all the vigorous efforts of colonization, a large area still remained unirrigated and range land.

In 1916, the Canadian Pacific developed the St. Julien colony for the veterans of World War I. It was situated south of Tilley and the company itself undertook the irrigation of 40 acres on each of twenty-five farms, each containing 160 acres.[16] A. Griffin mentioned in his 1916 Annual Report that Bassano, Gem, Brooks, Tilley, Rosemary and Duchess were settled and the total irrigated area occupied was approximately 23,000 acres. He further stated that a small settlement was made in the vicinity of Lathom. During 1916 large irrigable land holdings were as follows:

1. Smith and Saar at Bassano and Lathom
2. Pattin at Bassano
3. Sutherland estate at Brooks
4. Elizabeth Farm at Tilley.

Excluding the above, the irrigable holdings ranged from 70 acres to 320 acres, the average holding being about 100 acres.

The Duchess area was settled by Americans particularly Pennsylvania

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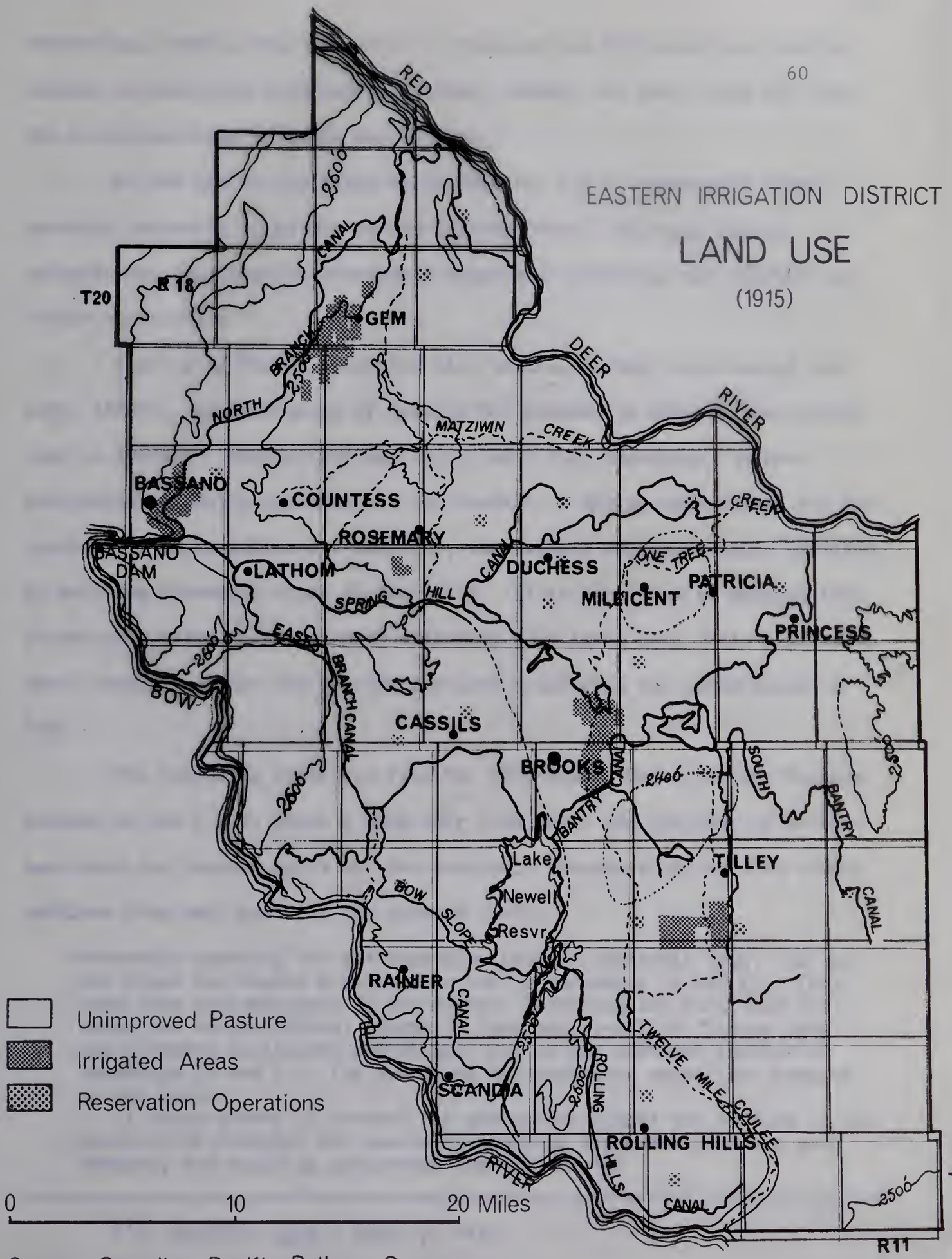
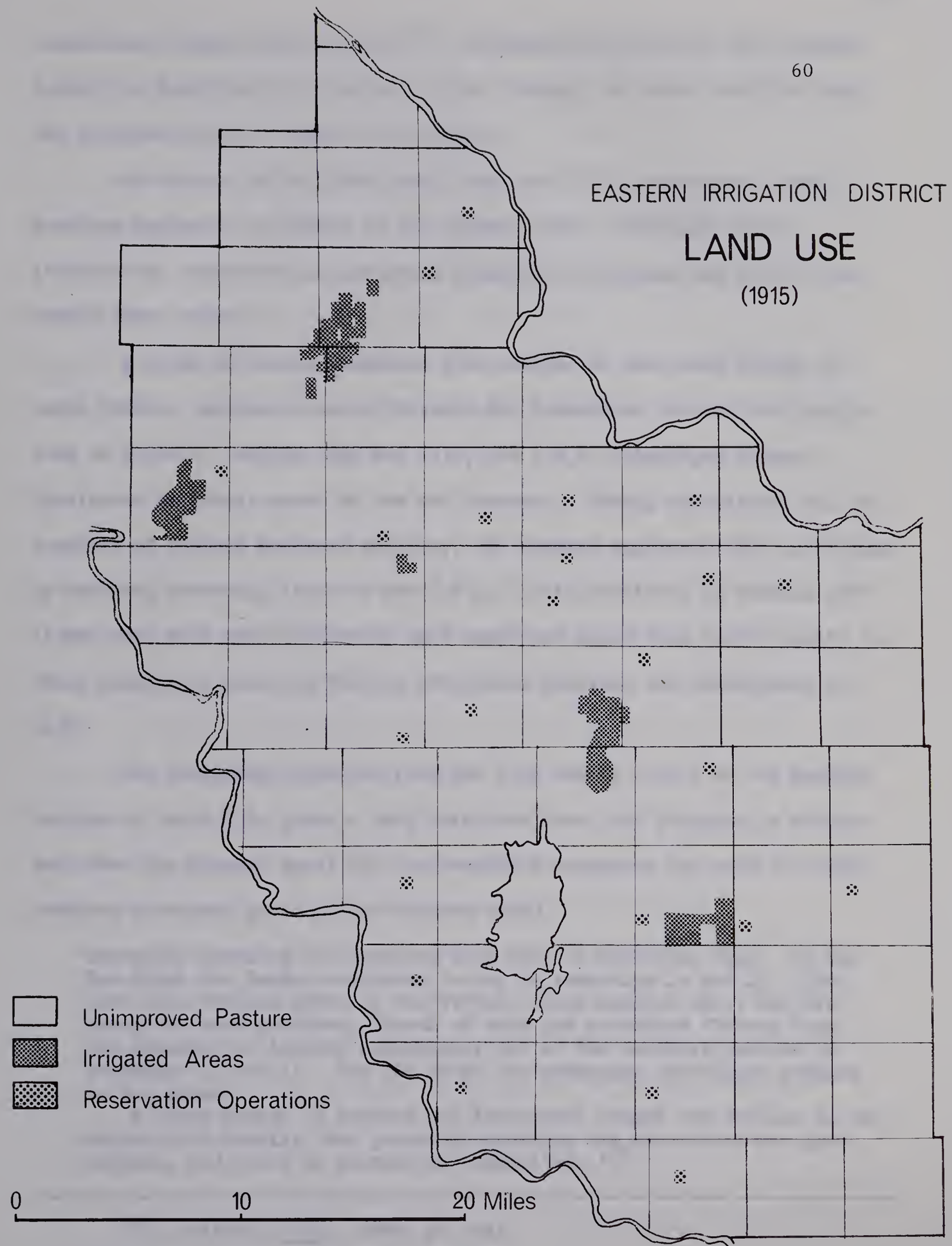
[16] J. B. Hedges, Ibid., p. 299.



Source: Canadian Pacific Railway Company, Irrigation Dept.

Fig.9

RED
RIVER
DEER
CREEK
MATZIWIN
CREEK
CANAL
BRANCH
NORTH
CANAL
BRANCH CANAL
BOW
SLOPE
BOTTLE
HILLS
RIVER
CANAL
T20
R18
GEM
COUNTESS
ROSEMARY
BASSANO
BASSANO DAM
LATHOM
DUCHESS
PATRICIA
MILDICENT
ONE TREE
HILL
SPRING
EAST
PRINCESS
CASSILS
BROOKS
SOUTH
BANTRY
TILLEY
Lake
Newell
Resvr
RANIER
SCANDIA
TWELVE MILE COULEE
ROLLING HILLS
R11
T



Source: Canadian Pacific Railway Company, Irrigation Dept.

Fig.9

Mennonites, between 1916 and 1919.[17] Patricia and Millicent were settled largely by Americans from Nebraska, Iowa, Kansas, the West Coast and from the irrigated areas of Idaho and Wyoming.

At the end of the First World War, the C.P.R. encouraged French speaking Quebecois to settle in the Rosemary area. Although fairly industrious, they were inexperienced regarding irrigation and drifted away within three years.

A group of Mormon Americans also settled in this area during the early 1920's. Another group of Seventh Day Adventists entered the Cassils area in 1920-21. During 1929 and 1930, the C.P.R. encouraged German-Ukrainians to settle south of Gem and Rosemary. Having experienced all the troubles of an East European minority, the Germans expressed their gratitude by becoming intensely loyal to the C.P.R. It is pertinent to mention that it was only with some difficulty that they were lured from their loyalty to their benefactor when the Eastern Irrigation District was established in 1935.

The following quotation from the 1919 Annual Report on the Eastern Section of the C.P.R. gives a very fair idea about the progress of settlement when the Company spent all its available resources and tact to induce settlers from many parts of the Western world.

> "Generally speaking the settlers have been of desirable type. On the Bow Slope the Swedes continued to buy in townships 14 and 15. They come from various parts of the States, speak English well, and are among the best settlers. North of them the so-called "Tacoma Camp" has extended to include practically all of the northern portion of townships 16 and 17. The Bow Slope has undergone marvellous changes in two years.
>
> A large number of Seventh Day Adventists bought and settled in the vicinity of Cassils, and generally speaking the Adventists are good farmers, and build up prosperous communities."[18]

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[17] A. Griffin, Ibid., 1920, p. vii.

[18] Idem., 1919, p. v.

The vigorous efforts of the company were fruitful and the company was able to settle the area with people from all parts of the western world. Figure 10 shows the total picture of the population including the villages and towns of the Eastern Section from 1901 to 1961. This increase may give a wrong impression of population growth as there was not increase in all the townships in the Section. The increase was generally in the townships which were under irrigation-farming. A good example will be that in Townships 14, 15, Ranges 13, 14 (Rolling Hills area), the population did not start growing until after 1931 (see overlay Fig. 29,p.106 and Table VIII). It is also a fact that the populations of Bassano and Brooks did not grow very much from 1911 to 1941. The population of Brooks increased from 499 in 1921 to 888 in 1941 and the population of Bassano increased from 540 in 1911 to 582 in 1941.[19] Bassano was incorporated a village earlier than Brooks and so the population of Bassano is available from 1911 and of Brooks from 1921. The population was higher in Bassano in 1921 and 1931 than in 1941 and it was as a result of construction work at the dam, canals and ditches. The population in Township 20, Range 18 was 700 in 1911 when Bassano Dam was constructed and then after completion of works it declined sharply (see overlay Fig. 29, p. 106). In all townships where canals and ditches were constructed population increased during this period of work.

Irrigation development was mainly instrumental in the increase of population of the Eastern Section from 1911 to 1941. The exploration of natural gas and oil in the Brooks area and other secondary and tertiary services also caused the increase in population in Bassano, Brooks and Duchess but after 1936 only.

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[19]Census of Canada, Dominion Bureau of Statistics, Ottawa, 1901 to 1966.

EASTERN IRRIGATION DISTRICT

TOTAL POPULATION INCREASE

1901-1961

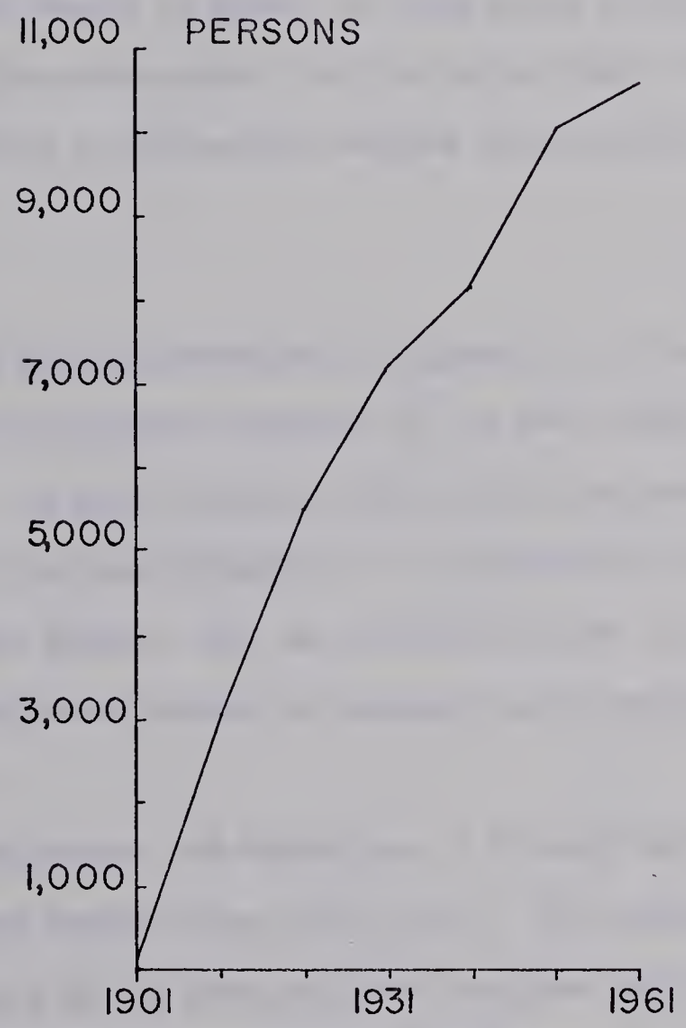

Fig. 10

It would be wrong to attribute the whole of this increase in population to the availability of irrigation water. Obviously the population of Eastern Section would have increased even if it remained a ranching and dry land-farming area but not so much as under irrigation-farming. There has been more rural depopulation in the dry land-farming areas in the north of the Eastern Section. Depopulation was obvious during the dry thirties in Southeastern Alberta. The stability of population in the irrigated areas was mostly the result of surety of crops which provided basic security to the settlers. This also seems to be the basic reason for the early increase in population of the service centres such as Brooks, Bassano and Duchess.

CROP DEVELOPMENT:

Data for all crops represented in figures 11, 12 are taken from the Ditch Riders Reports submitted regularly to the head office of the Eastern Section in Brooks. No crop data from 1928 to 1940 are available from the records of the Section, presently in the possession of the Eastern Irrigation District, Brooks. But the projected trends in 1941 show that there had been continuous increase in acreage under cereal and forage crops with few drops.

Figure 11 represents the comparison in acreage under all crops and wheat in the Eastern Section from 1915 to 1927. The trends show that wheat remained a major crop in the Section for a long time until there was a demand for other specialty crops or the settlers were able to grow more diversified crops. Figure 12 shows the acreage under forage and cereal crops from 1915 to 1927. The trends show that increasing emphasis was placed on forage and feed crops in the area.

It could very well be seen that since the start of irrigation in the Eastern Section, the emphasis remained on cereal and forage crops. By 1925,

EASTERN IRRIGATION DISTRICT

TOTAL CROPS AND WHEAT

1915 – 1927

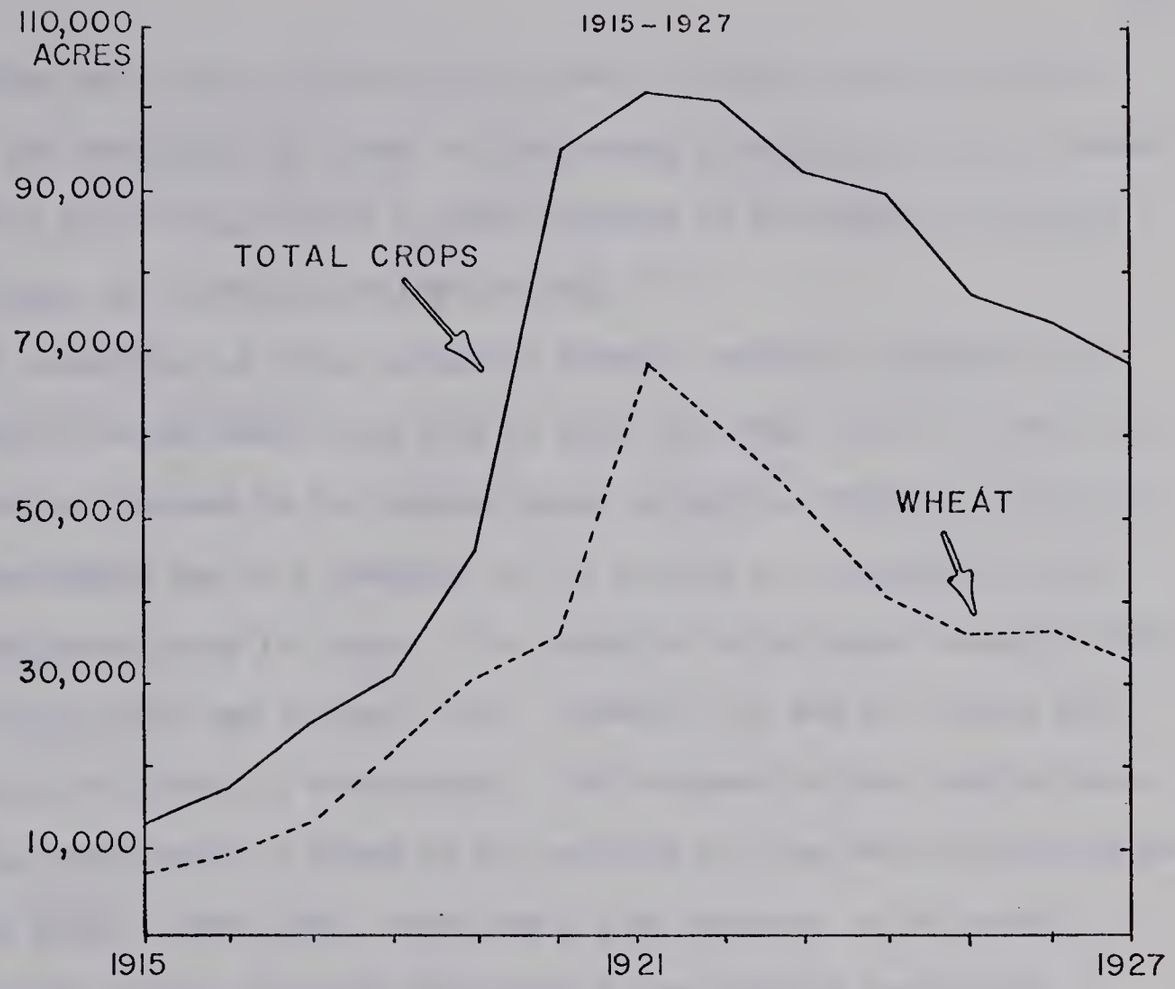

Fig. 11

EASTERN IRRIGATION DISTRICT

ALFALFA, FLAX AND CEREAL GRAINS

1915 – 1927

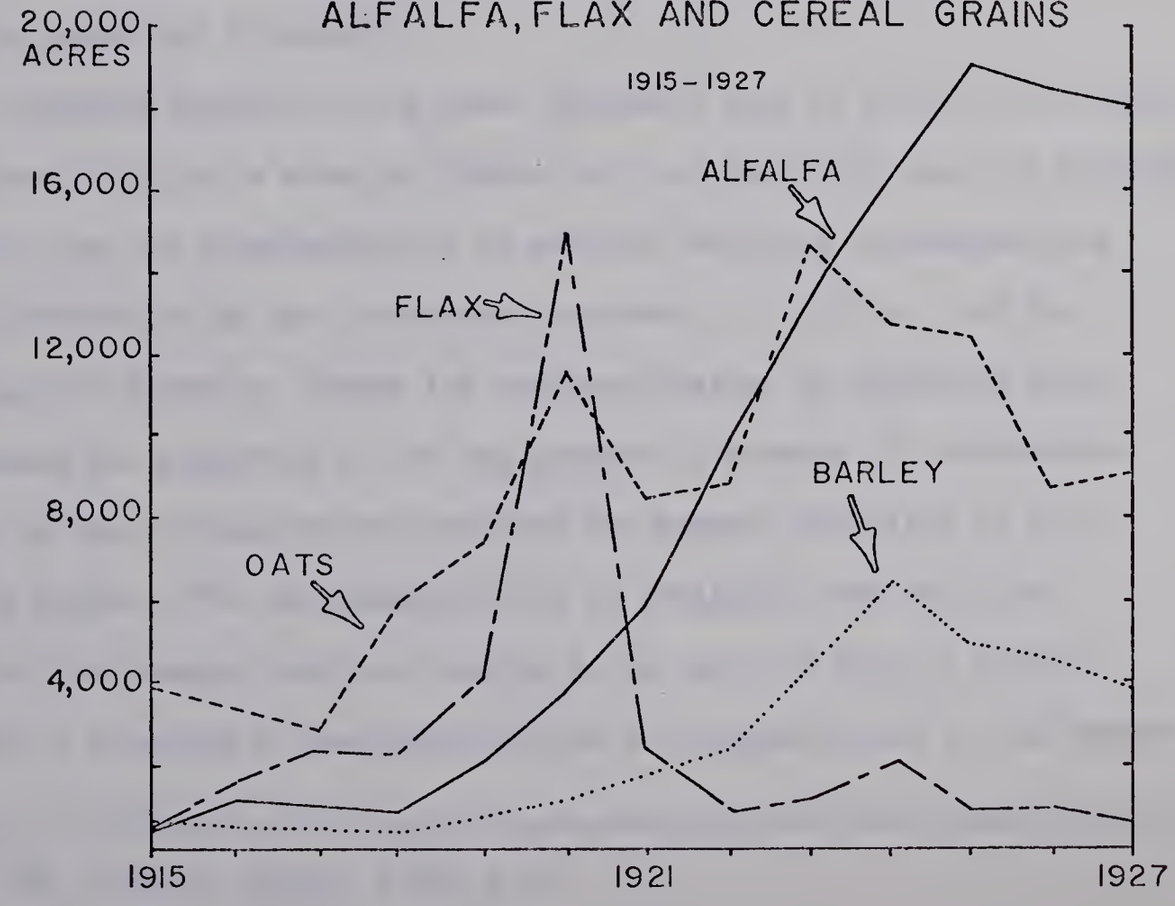

Fig. 12

the Section had over 15,000 cattle and then the number declined, due in part to the abandoning of farms and the moving of settlers to other areas. Irrigation also brought about a great increase in the number of poultry, sheep, hogs, and horses and mules (see Fig. 13).

A comparison of total irrigable acreage, actually irrigated area and number of water-users from 1912 to 1934 (see Figs. 14, 15) shows that there was an increase in the acreage under irrigation except in 1923 and 1927 when nature was very gracious to the farmers and they did not use much irrigation water for crops. The number of water-users increased from 1913 to 1921 which was the peak year. Between 1921 and 1927 there was a decline in the number of water-users. The reasons for this decline seem to be the abandonment of farms by the settlers and the better precipitation in these years. After 1927, there was a slow increase in the number of water-users and this could be attributed to dry weather conditions, a trend towards more intensive farming and improved market demands for specialty crops and livestock.

The sharp decline in the total irrigable area in 1932-22 due largely to reclassification is shown in Figure 14. One important cause of reclassification was the dissatisfaction of settlers who sent representations to the authorities of the Irrigation Department, C.P.R. Co., and the Department of Interior, Ottawa for reclassification of irrigable area. This demand was supported by the non-payment of arrears of instalments by some of the settlers which compelled the company officials to look into the matter. The re-classification of irrigable land was also forced on the company with the decline in the sale of land in 1932.[20] By 1934, as a result of re-classification of irrigable land in the Eastern

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[20]A. Griffin, Ibid., 1932, p. 2.

EASTERN IRRIGATION DISTRICT

LIVESTOCK AND POULTRY

1918 - 1927

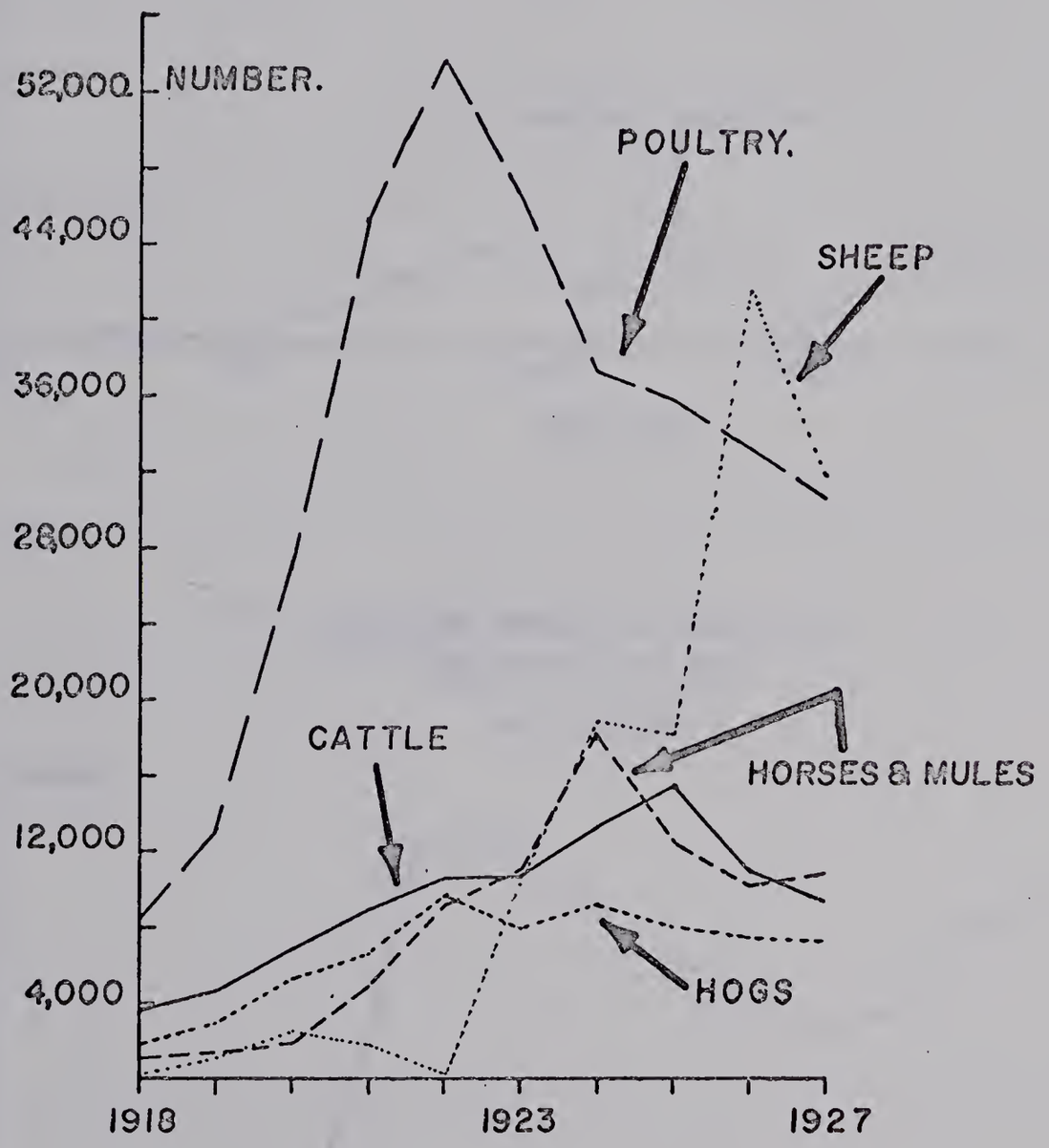

Fig. 13

EASTERN IRRIGATION DISTRICT

TOTAL IRRIGABLE AND IRRIGATED AREAS

1912 – 1934

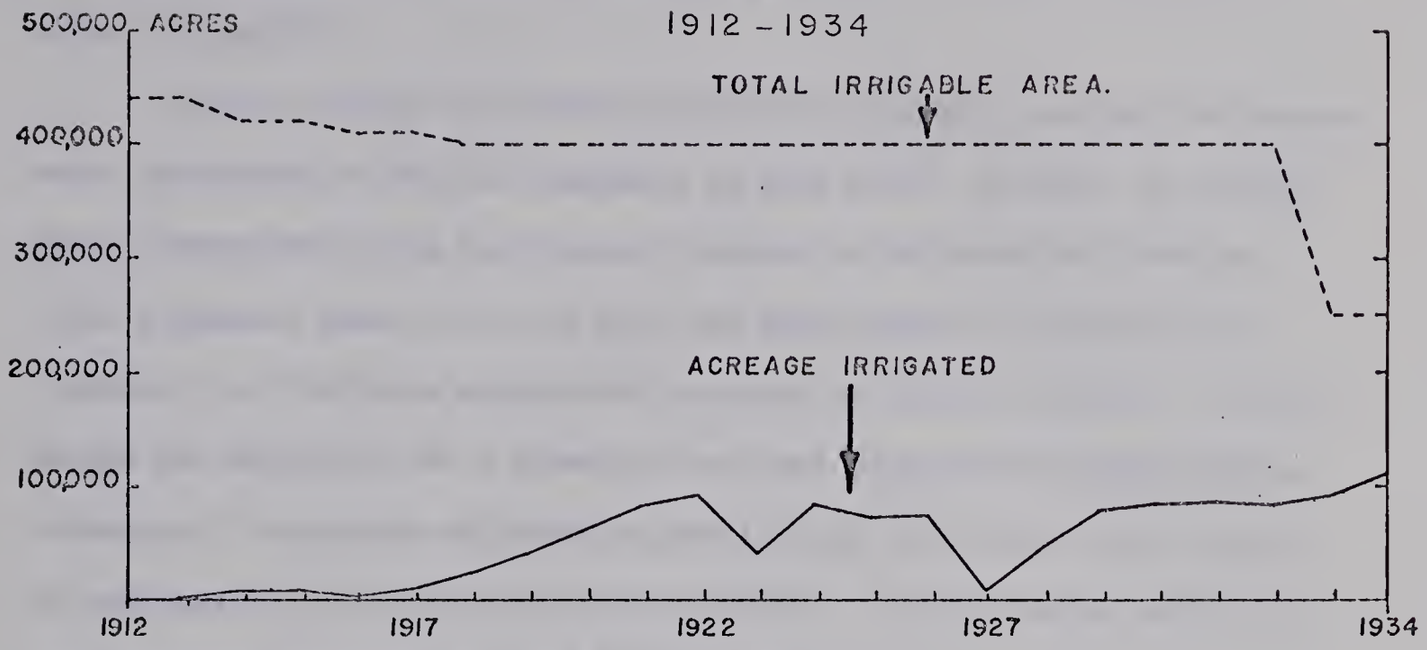

Fig. 14

EASTERN IRRIGATION DISTRICT

WATER-USERS

1912 – 1934

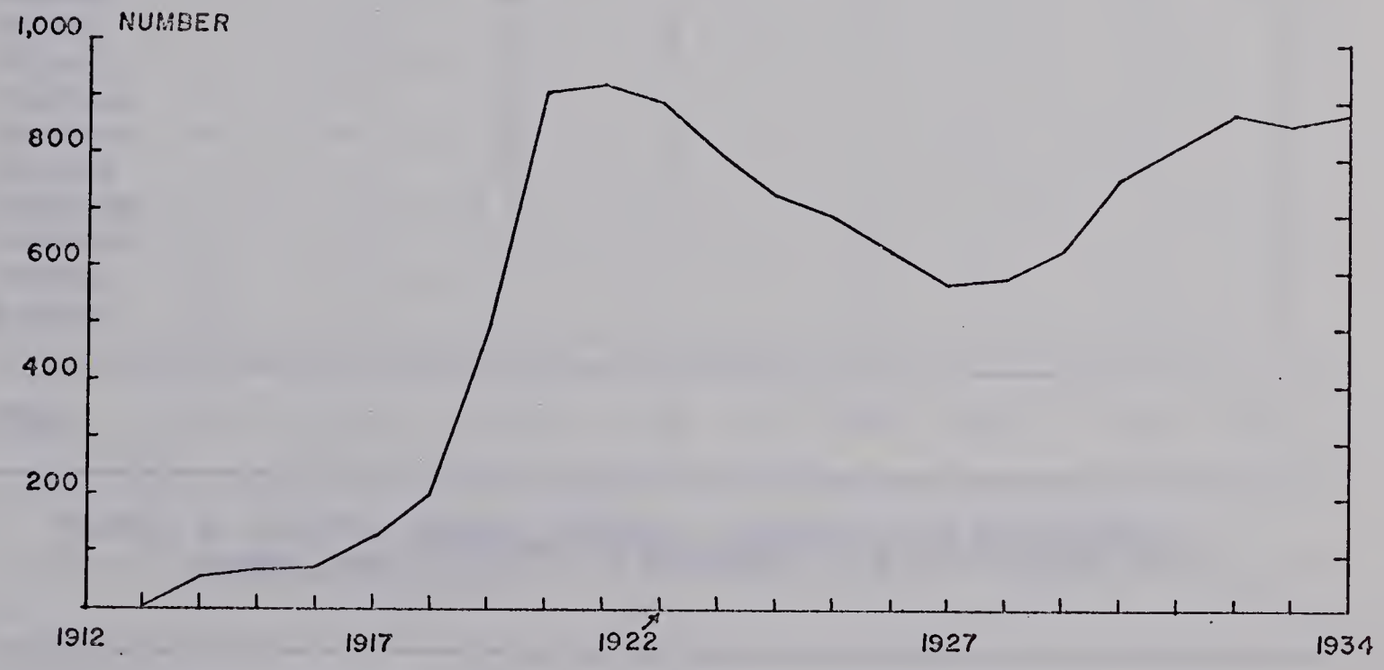

Fig. 15

Section, the acreage decreased from 440,000 acres in 1912 to 242,239.75 acres in 1934.[21]

As the acreage under different crops increased, new grain elevators were constructed by various companies in this area. In 1919, the Ogilvie Grain Company built its first grain elevator in the area and later on other companies came so that by 1923 the total number of elevators had increased to 17 with an approximate capacity of 410,000 bushels. In 1923, Brooks and Millicent had 3 elevators each and Scandia and Rainier had no elevators. The number of elevators declined by 1927, may be as a result of amalgamation of certain elevator companies. The following table will show elevator locations in 1927.[22] (See Table X).

TABLE X - GRAIN ELEVATOR LOCATIONS IN THE E.I.D., 1927

	COMPANIES							
Place	Pool	Pioneer	Alberta Pacific	Victoria	Ogilvie	Robin Hood	Crescent	Total
Bassano	-	-	1	-	1	1	1	3
Cassils	-	-	-	-	1	-	-	1
Brooks	-	-	1	1	-	-	-	2
Tilley	-	1	-	-	-	-	-	1
Countess	-	-	1	-	-	-	-	1
Rosemary	-	-	1	-	-	-	-	1
Duchess	-	-	1	1	-	-	-	3
Millicent	-	-	1	-	-	-	-	1
Patricia	-	-	1	-	-	-	-	1
Scandia	1	-	-	-	-	-	-	1
Rainier	1	-	-	-	-	-	-	1
TOTAL	2	1	7	2	2	1	1	16

Source: A. Griffin, Eastern Section, (Operation and Maintenance), Annual Report, 1927, C.P.R.Company, D.N.R., Calgary, 1927, p. 2.

[21] Idem , 1934, p. 1.

[22] Idem , 1927, p. 17.

SECONDARY DEVELOPMENTS:

The prosperity of the developing communities on irrigation-farming became the focal point of various banking enterprises. The Royal Bank of Canada opened its branches at Bassano on July 22, 1909, Brooks on February 15, 1910, and Duchess on August 7, 1919.[23] The Royal Bank at Duchess was closed in 1936. The possible reason for the decline in number of banks could be due to the development of better services in Bassano, and Brooks for the surrounding areas and more interest in the area by the new banks. It seems relevant to mention that the Royal Bank of Canada, Brooks, assisted the Eastern Irrigation District financially in taking over from the C.P.R. in 1935 and was the sole source of financing for farmers in the area until around 1940 or thereabouts when the Alberta Treasury Branch and the Bank of Nova Scotia came into the Section.[24]

DEVELOPMENT OF TRANSPORTATION SYSTEM:

In 1903, there was only one C.P.R. line serving the area joining Medicine Hat in the East and Calgary in the West. There were prairie trails but no gravel or paved roads. The C.P.R. Company built another railway line connecting Bassano with Empress via Countess, Rosemary, Duchess, Millicent, Patricia, Princess and Denhart in the Eastern Section. Bassano was also linked with Calgary via Hussar in the north-west. Later in 1927 C.P.R. completed its track joining Scandia with Cassils through Rainier with the main Medicine Hat-Calgary line. The Company proposed a new rail link joining Brooks to Eyremore across the Bow River in the south-west and reaching Kirkcaldy; and connecting Kinninvie, Brooks, Gem and Hussar. This

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[23]Pers. comm., H. A. Stackhouse, Manager, the Royal Bank of Canada, Brooks, April 24, 1968.

[24]Ibid.

scheme did not materialize, but in 1927 a track was built connecting Gem with Rosemary. The line then continued north from Mitiziwin to Bullpond and crossing the Red Deer River near Finnegan Ferry it reached Drumheller.

The Canadian Northern Railway Company started work on the District Section of the Hanna-Medicine Hat line and it was included in the Canadian National System in 1917. The grading of the section was completed between Hanna and Medicine Hat in 1923. It was planned to run a weekly service between Hanna and Steveville. No steel had been laid on the portion from the Red Deer River to Medicine Hat. The concrete piers of the bridge across the river were completed in 1922 but no further work was done on this section of the proposed railway line.

A gravelled highway followed the C.P.R. track joining Medicine Hat with Calgary via Kinninvie, Tilley, Brooks, Duchess, Rosemary, Countess and Bassano. Another gravel road connected Vauxhall with Hanna via Scandia, Brooks and Duchess. The Trans-Canada Highway was straightened and paved after 1950. Other roads from Brooks to Duchess and Vauxhall have been improved from 1960-65. By 1931, a network of dirt roads developed within the Eastern Section and Bassano (population 615), Brooks (population 708), Duchess (population 114) became the main service centers in the area. Brooks being the district headquarters was the main center of annual agricultural fairs and other social and cultural activities.

DEVELOPMENT OF HOSPITALS AND SCHOOLS:

Owing to road conditions and slow transportation facilities, the early settlers did not admit to themselves any minor sickness or ailment. Possibly because of the youthful age of most settlers, combined with the healthy atmosphere in a new country there was very little sickness. There were two hospitals, at Brooks and Bassano, which served the irrigation community.

The next serious problem was of schools and the settlers were

faced with the formation of school districts, the construction of schools and the procurement of teachers. In October, 1919, two schools were opened at S.W. 27-16-16 and at Swede Colony in N.W. 8-15-15 and two other new school buildings were ready in Rosemary and Countess but no classes were held due to non-availability of school teachers. By 1925 there were six School Divisions in the Eastern Section and the school districts in each school division are as listed below.[25] (See Table XI).

Because of transportation difficulties and distances between communities small schools were started but the difficulty of procuring teachers was faced by the school administration boards.

GENERAL CONDITIONS IN THE EASTERN SECTION BEFORE IT WAS TRANSFERRED TO THE FARMERS IN 1935:

The early settlers did not make the financial progress that they and the company had anticipated; economic conditions right after the First World War in 1921 and 1922, became very grave. Practically the only crop that, at that time, could be successfully grown and marketed was wheat. But in 1923, the prices of wheat collapsed disastrously, and it affected the farmers' income drastically. In ten years, from 1923 to 1933, many of the original settlers abandoned their farms and most of those remaining were disappointed and suffered as a result of low prices they continuously received for their agricultural products. In 1928, the C.P.R. lightened the demands by removing interest arrears on many debts. The depression from 1931 to 1935, sparked the dissension that was in the minds of the people.

In 1930, near the start of the depression, the farm prices fell and various United Farmers of Alberta groups organized a district U.F.A.

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[25]A. Griffin, Ibid., 1925, p. 20.

TABLE XI

SCHOOL DISTRICTS IN EASTERN SECTION

SEASON OF 1925

BASSANO DIVISION

BASSANO SCHOOL DISTRICT	- Town of Bassano
LATHOM do do	- do do Lathom
BURN BRAE do do	- NE ¼ 18-21-17-4
CLEMENCEAU CONS'L'D. SCHOOL DISTRICT	- SE ¼ 17-21-16-4
ROSEMARY do do do	- TOWN OF ROSEMARY
GEM do do do	- NE ¼ 36-22-17-4

DUCHESS DIVISION

ALLAN CAMERON SCHOOL DISTRICT	SW ¼ 26-21-15-4
WEST DUCHESS do do	NE ¼ 36-20-15-4
DUCHESS do do	TOWN OF DUCHESS
WELLMAN do do	NE ¼ 16-21-14-4
CLANCY do do	NW ¼ 4-20-14-4

BANTRY DIVISION

PRINCESS SCHOOL DISTRICT	NE ¼ 17-20-12-4
HADDINGTON do do	TOWN OF PATRICIA
MILLICENT do do	do do MILLICENT
SUTHERLAND do do	NE ¼ 2-19-14-4

BROOKS DIVISION

BROOKS SCHOOL DISTRICT	TOWN OF BROOKS
CASSILS CONS'L'D SCHOOL DISTRICT	NW¼ 5-19-15-4

TILLEY DIVISION

TILLEY SCHOOL DISTRICT	SW¼ 24-17-13-4
RENFREW do do	NE¼ 35-16-13-4

BOW SLOPE DIVISION

JENNY LIND CONS'L'D SCHOOL DISTRICT	NW¼ 8-15-15-4
BOW SLOPE SCHOOL DISTRICT	SW¼ 27-16-16-4
ALCOMA do do	SE¼ 24-16-16-4
KITSIM do do	SE ¼ 16-17-16-4

Source: Annual Report of the Superintendent of Operation and Maintenance, 1925.

to attempt to win better terms from the C.P.R. After some refusals, the C.P.R. finally agreed to make changes if the farmers would assume responsibility for the distribution of the irrigation water. Accordingly the U.F.A. established a small committee consisting of Messrs. W. Tait White, Carl J. Anderson and William Sheldrake and a large committee of seventeen members to deal with the C.P.R. The smaller committee was the more efficient of the two and did most of the work. It is interesting to note that many farmers opposed the idea of a change in their relationship with the C.P.R., and branded the committees as "radical" and "Bolshevik". Rev. C. J. Ramer, of the Mennonite Church, Duchess, on February 22, 1935, protested the establishment of the Eastern Irrigation District as being contrary to sound business principles, and against Mennonite religious principles.[26] The following statement showing the result of checking petitions for and against the formation of the irrigation district, February 20, 1935, will explain the detailed situation.[27] (See Table XII).

This statement shows that quite a significant number of settlers did not vote on the petition and remained disinterested in the whole affair of the irrigation district formation. This apathy of the contract holders could be due to two reasons - distrust in the U.F.A. movement and doubts about the satisfactory patronage of new administration replacing the Company. During this period the Provincial government refused to intervene actively until the C.P.R. and the farmers came to an agreement.

In the spring of 1934, a tentative agreement was made. In return for the Eastern Section's assets, machinery, staff houses, and 1,250,000

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[26]L. Burns, (ed.) History of Agriculture, The C.P.R. Company Irrigation Blocks 1894-1943, Part II, the Eastern Section, Glenbow Foundation, Calgary, Aug., 1959, p. 160.

[27]Ibid., p. 221, Appendix No. 2.

TABLE XII

STATEMENT SHOWING RESULT OF CHECKING PETITIONS FOR AND AGAINST THE FORMATION OF AN IRRIGATION DISTRICT, FEBRUARY 20, 1935

	Govt. Summation		C.P.R.Summation	
	Contracts	Contract Holders	Contracts	Contract Holders
Final Water Agreement	61	26	63	27
Contracts	787	733	789	711
Total	848	759	852	735

AREAS	ACRES	ACRES
Voted For	66,189.00	Not given
Voted Against	15,859.00	" "
Not Voted	54,595.00	" "
CONTRACTS		
Voted For	407	Not given
Voted Against	89	" "
Not Voted	287	" "

Non-resident Contract Holders According to C.P.R. summation	127
Less non-residents who signed Petition	4
Net number of non-residents	123

Source: L. Burns (ed.) History of Agriculture, The C.P.R. Company, Irrigation Blocks, Part II, The Eastern Section, Glenbow Foundation, Calgary, Aug. 1959, p.160.

acres of land, the farmers agreed to pay the C.P.R. an initial sum of $500,000 and $25,000 per annum for twenty years thereafter. The farmers accepted the plan proposed by their representative committees. Their water rates would be increased from $1.25 per acre to about $1.80 per acre, but their past debentures would be wiped out. They would be able to buy their land for from $5.00 to $10.00 per acre.

Later because of the auditor's report, the financial position of the Eastern Section of the C.P.R. was revealed. The farmers, therefore, announced that they would take over the Eastern Section only if the C.P.R. paid them $400,000 rather than their paying the C.P.R. half a million dollars. The C.P.R. records indicated that the Company had experienced a $400,000 yearly deficit on the Eastern Section during the previous six years. The farmers finally expected their demands to be rejected.

After the expression of some anger and annoyance, the C.P.R. officials offered the farmers $300,000. The farmers were surprised at the offer of the company and agreed to this proposal. At this point, the provincial government intervened and passed legislation to facilitate the establishment of the Eastern Irrigation District. An opposition movement among the farmers of the Eastern Section failed to move the provincial government. This opposition could be due to various reasons namely, apprehension about the role of farmer-management, loyalty to the Company, too low offer from the C.P.R. Company or against government take over.

CONCLUSIONS:

A part of the 1903 Land Grant to the C.P.R. was in the "Palliser's Triangle" which Palliser considered unfit for settlement based upon dry farming. The area which was considered capable of supporting one cow per 24 acres as dry land became one of the largest farmer-owned and operated

districts in Canada. The most important contribution of irrigation to the Eastern Irrigation Section was the stabilization of agriculture and significant increase in the production of alfalfa, cereal grain, potatoes, canning crops, and irrigated pasture. Actually the long-range plan of the Company was to create the greatest possible volume of railway traffic and irrigation made it possible. It thus provided the ideal outlet for many farm products and agricultural byproducts and at the same time conserved or increased the general fertility.

It is true that "dry-land farming" brings more economic returns as compared to "irrigated farming" for individuals in certain areas but it does not provide for a stable and expanding agricultural economy due to natural factors. This aspect of uncertainty in a "dry-land farming" area hinders the gradual development of secondary and tertiary services. In an irrigated area the stability in the agricultural economy brings phenomenal change in the whole community life. The income of the farmer increases and there is more demand for goods and services. In the case of Eastern Section, the Company achieved its aim in developing a large volume of traffic as a result of increased production in crops and livestock. This has contributed to more capital investment thus generating economic expansion and a growth in a demand for more services. Such factors have generated economic expansion, followed by increased employment, increase in population, more goods and the need for services.

CHAPTER IV

LAND USE CHANGES SINCE 1935

INTRODUCTION:

After the formation of the District in 1935, a survey showed that not over 90,000 acres were being irrigated. As a result of the low price of land, an ability to work with their own trustees and engineers, assistance from the P.F.R.A., and, most important, increased markets for irrigated crops during World War II and later years, the district prospered and irrigated acreage increased to 196,549 acres in 1967. In many instances the farmers themselves developed more land by levelling adjacent rough areas, and in other instances the District has made land available by rebuilding old ditches and constructing new ditches. Because of various factors such as, economic conditions after the First World War, reclassifications of irrigable land, decreases in the costs of farms purchased from the C.P.R. Company, farmer ownership and operation of the project, over 85 per cent of the farmers were able to procure titles to their farms within the first fifteen years of the project's life. The settlers were able, with a greater choice of crops and uniform and higher yields to pay for their farms and build good homes under the new contracts with the District.

DEVELOPMENT OF ROLLING HILLS SECTION:

When the Eastern Section was transferred to the farmers by the company in 1935, the government of Alberta incorporated it as the Eastern Irrigation District under the Irrigation Act. It was planned to develop irrigation farming in the Rolling Hills section of the District. The land surface is quite level, the soil a fine sandy loam to loam, and in general the whole block is physically very well suited for irrigation. Main irrigation canals had already been extended in the early years of development

by the C.P.R. Company in this level stretch of the country. But this block was not developed because of the scanty supply of settlers available for irrigated lands. In 1938, the old works constructed for this area were refurbished and extended by the E.I.D. which spent approximately $300,000 on the development of the project.

The P.F.R.A. paid $50,000 to the District as a part of the total cost and the District in return credited each purchaser of land in the section, which was sponsored by the P.F.R.A., with a cash payment of $2.00 per acre on his contract.[1] The settlers acquired land from the District under a lease agreement with option of purchasing by contract at the end of two years. A small rental fee was charged to the settlers amounting to $10.00 per quarter section and a water charge based on one-half the regular rate for irrigable land was also levied against him. Where a school district was formed the settler was required to pay school taxes. The most frequent size of the holding was the quarter section. The P.F.R.A. also spent an additional amount of $21,000 in levelling land with machinery supplied by the District and approximately 100 acres on each quarter section was broken before the arrival of settlers.

Under an arrangement effected by the P.F.R.A. with the District, development was resumed in the late thirties, and settlement by farmers took place. This was a part of a resettlement of farmers who had been victims of a combination of drought and poor land selection. In addition their farming units had been too small to provide adequate return or they had land that was being incorporated into Community Pastures in parts

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[1] C. S. Burchill, Development of Irrigation in Alberta - An Historical Survey, Canada Dept. of Agriculture, Economics Division, Edmonton, 1949, p. 18.

of southern Saskatchewan and Alberta. Approximately three-quarters of the settlers in Rolling Hills were farmers who had moved out of the above dried-out areas. The remainder, for whom the north-west quarter of each section was reserved, were experienced irrigators, chiefly farmers' sons from the E.I.D. In June 1941, there were about 104 resident farmers in the area. Two years earlier there were less than five and a year later there were 140 resident farmers.[2]

The average size of the 37 farms described in "Farming in the Irrigation Districts of Alberta" was 177 acres of which 130 acres were irrigated crop land, 5 acres dry crop land and the remaining 42 acres were pasture, though the settlers had also used community pastures.[3] The acreage under crop in the Rolling Hills section of the District is shown in the following table. (See Table XIII).

TABLE XIII - AVERAGE SIZE OF FARM, AMOUNT IRRIGATED, AND CROPS GROWN IN 1940 IN THE ROLLING HILLS AREA

Land Use	Farms with item #	Average Ac./ Farm Ac.	Percentage of Total Area
Total Area	37	177	100
Irrigated	37	130	73
Dry Crop Land	--	5	3
Flax	35	63	36
Wheat	33	39	22
Oats	34	16	9
Barley	14	4	2
Brome and Sweet Clover	6	1	1
Alfalfa	6	1	1
Breaking New	18	11	6

Source: S. S. Spence, B. H. Kristjanson and J. L. Anderson, Farming in the Irrigation Districts of Alberta, Technical Bull. No. 61, Dominion of Canada, Dept. of Agriculture, Nov. 1947, p. 51

[2]C. C. Spence, B. H. Kristjanson and J. L. Anderson, Farming in the Irrigation Districts of Alberta, Technical Bull. No. 61, Dominion of Canada, Dept. of Agriculture, Nov. 1947, p. 50.

[3]Ibid., p. 51.

The Rolling Hills colonization project has been remarkably successful. Of the first 152 men established, only 16 signed quit claims and left the district, a turn-over of only slightly more than 10 per cent in the first six years of operation. The project is now solidly established and prosperous. According to the County of Newell, 1955 records, 235 persons and companies owned the land in addition to the E.I.D. ownership, but by 1965 the number had decreased to 205. The decrease in number of owners showed the consolidation trends in the Rolling Hills area which is also true for the whole of the E.I.D. and in most agricultural areas of Alberta.[4] Since the opening of the Rolling Hills Section, more and more land has been put under irrigation, and there has been progressive consolidation, possibly due to mounting operation costs in irrigated agriculture.

Successful colonization here did not depend on the development of specialized crops; except for a small market for garden seeds, the district had to depend on the unspecialized markets for live-stock and grain, in which the comparative advantage enjoyed by irrigated land is minimal.

The success would appear to depend chiefly on three factors of policy, and one fortuitous factor.[5]

Firstly, the very low price charged for irrigated land was probably the most important single factor in ensuring the success of the project. From the first, there was every prospect that the farmer could become the owner of the land and of all improvements which had been placed on it. The

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[4]Bryce C. Stringam, The History of the Eastern Irrigation District, Brooks, May, 1960, pp. 35-36.

[5]C. S. Burchill, Ibid., p. 20.

incentive to improvement was strong and the rapid increase in the productivity of the district reflects the power of this incentive.

Secondly, the high proportion of experienced irrigators on the project ensured to every inexperienced man a neighbour on the adjoining farm who could supply advice and assistance.

Thirdly, the very careful selection of settlers and the preparatory work done in breaking and levelling land, both reduced the hardships of pioneering and ensured that the pioneers who had to submit to these hardships would be of a type not easily discouraged.

Lastly, it was a fortunate coincidence which established the settlement at a time when the prices for agricultural products were rising more rapidly than farming costs. No better time could have been chosen to initiate such a project than 1939-40.

CROPS:

Because of non-availability of crop data from 1928 to 1940,it is not possible to discuss the immediate impact of transfer of the District on its land use. But it can be safely inferred from a variety of information available that there was a gradual increase in the irrigated acreage. With the change in market patterns before and early in the Second World War, the demand for irrigated crops increased all over Canada and parts of U.S.A. It was a fortunate coincidence that the transfer of the District to the farmers and the increase in demand for irrigated crops which helped the farmers increase their income quite substantially occurred simultaneously. Data for crops from 1941 to 1966 are available from the Ditch Riders Reports submitted by them to the District. These reports are quite reliable and are used for the assessment of water-charge.

Since the transfer of the District to the farmers in 1935, there

has been continuous change in the land use. Direct involvement of the farmers in management and operation contributed to increased irrigated acreage and use of non-irrigated land for Community Pastures. The acreage under wheat, oats, barley and flax are represented in Fig. 16. There has been considerable fluctuation in the acreage under irrigated wheat in the E.I.D. since 1941. In 1949 and 1964, there was a substantial increase under wheat due to a favourable market. As regards oats and barley there has not been much change. The acreage under oats has fluctuated between 17,000 and 25,000 acres on a fairly regular four year cycle, with the years 1948, 1953, 1957, 1961 and 1964 marking low points.

It is quite interesting to note that the acreage under mixed grain has not increased since 1941. Possibly mixed grain was produced for domestic use and so was not affected by the market fluctuations. There has been appreciable decline since 1941 in acreage under sweet clover and alfalfa seeds. In 1927 about 18,000 acres were under alfalfa and this was the maximum acreage under irrigated alfalfa to that time. By 1941 the acreage had declined to about 12,500 acres (see Fig. 17) but since then it has shown an increasing trend with a maximum acreage in 1962. After 1962 the acreage under irrigated alfalfa hay has declined. It indicates the emphasis on the feed-livestock economy. Time to time impositions of quotas by the U.S.A. government have resulted in the decline of acreage under irrigated crops in most of the irrigated areas of Southern Alberta, e.g. alfalfa seed in 1953. Presently American potatoes are competing with Alberta potatoes in the Prairie Provinces and the interior British Columbia markets. The market conditions have led to the decline in acreage under potatoes in Vauxhall and Brooks areas. A comparative graphic representation

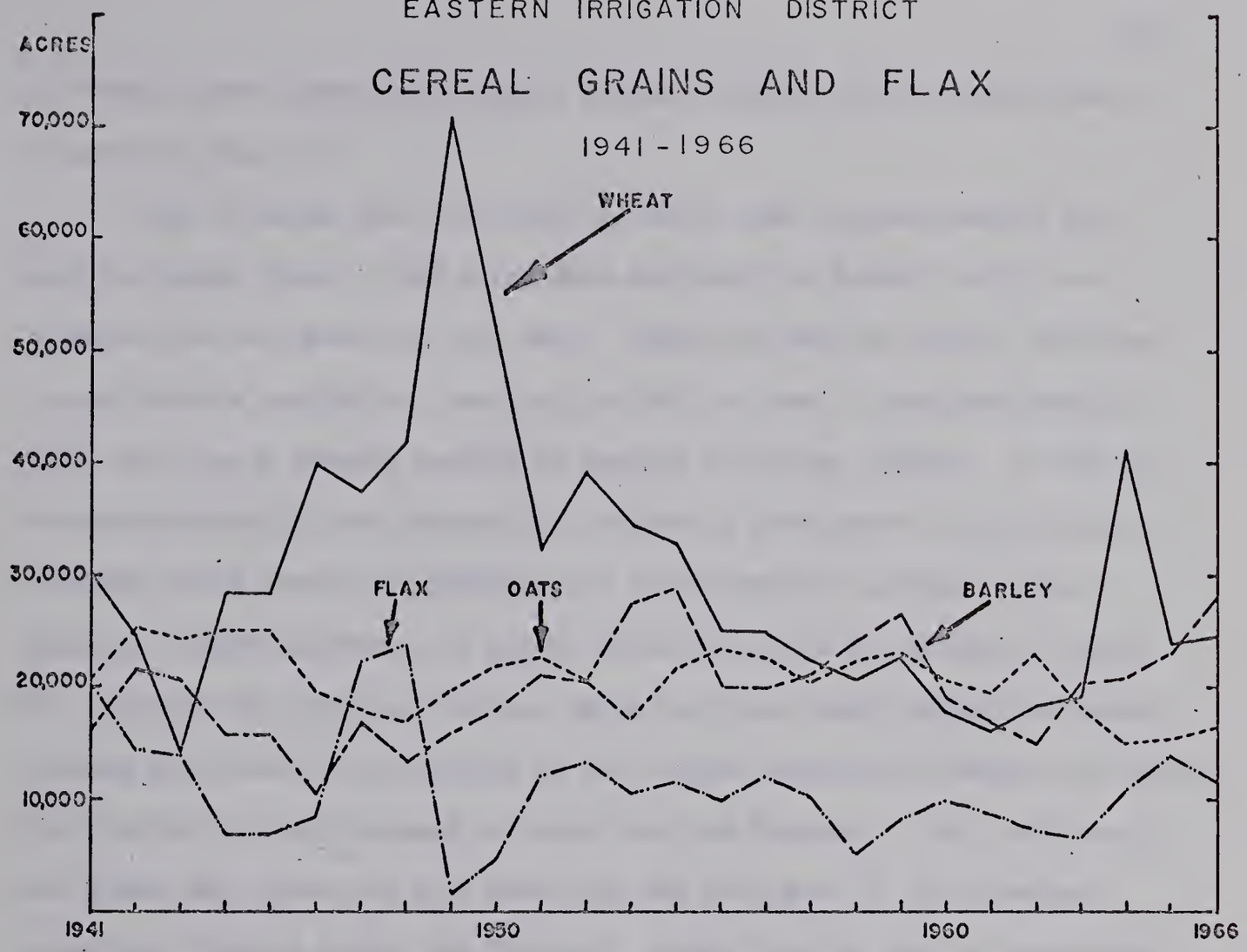

EASTERN IRRIGATION DISTRICT
CEREAL GRAINS AND FLAX
1941 - 1966
ACRES
70,000
60,000
50,000
40,000
30,000
20,000
10,000
WHEAT
FLAX
OATS
BARLEY
1941
1950
1960
1966

Fig. 16

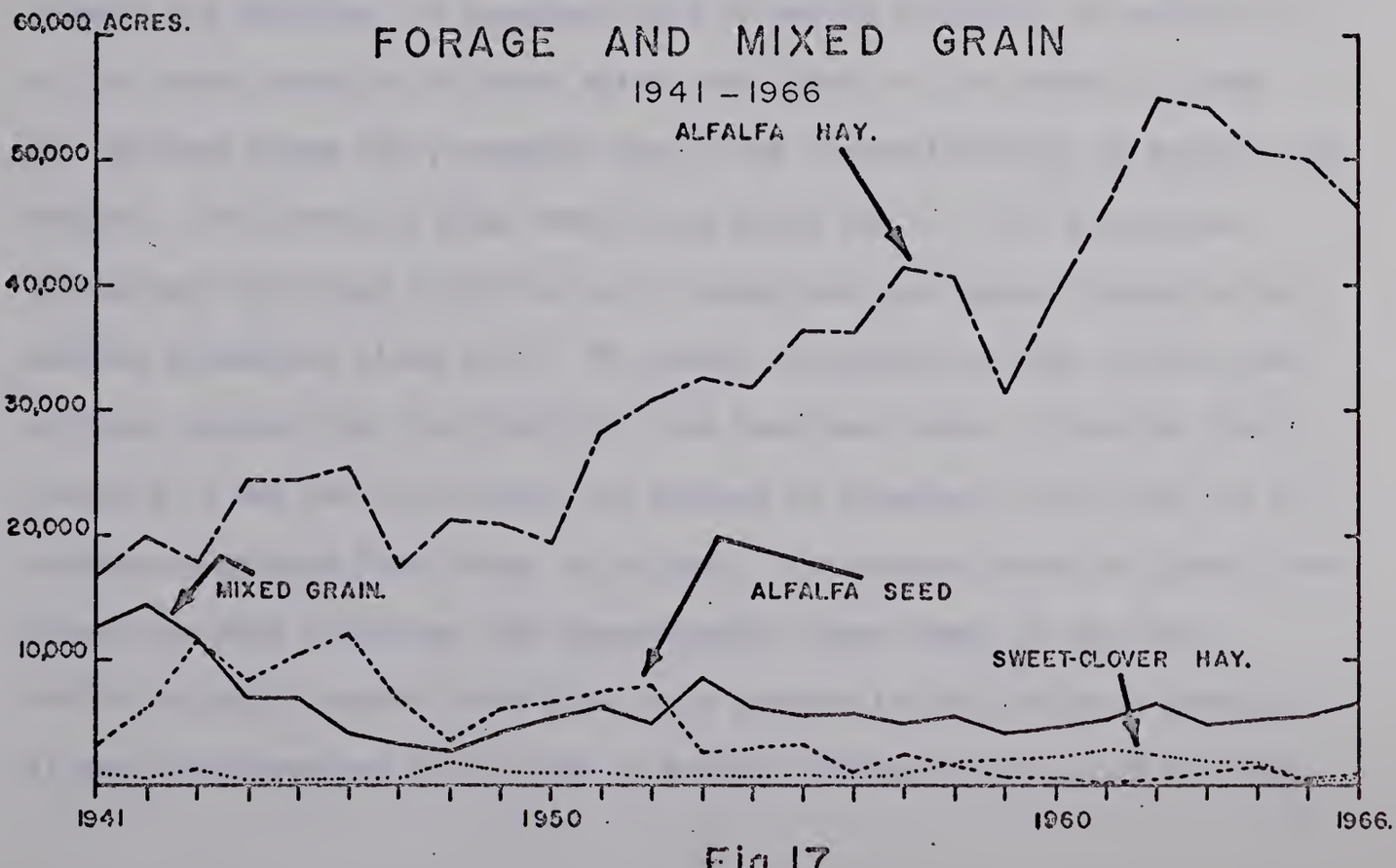

60,000 ACRES.
FORAGE AND MIXED GRAIN
1941 – 1966
ALFALFA HAY.
50,000
40,000
30,000
20,000
10,000
MIXED GRAIN.
ALFALFA SEED
SWEET-CLOVER HAY.
1941
1950
1960
1966.

Fig. 17

of acreage under mixed grain, sweet clover, alfalfa hay and alfalfa seed is given in Fig. 17.

Fig. 18 shows that the number of dairy cows has not changed very much in recent years. Most dairy cows are kept for domestic milk consumption and only some for milk sale. There has been an overall increase in beef cattle population from 1941 to 1956 but then it declined sharply. There was also a general decline in poultry and sheep numbers. It had not been anticipated by the planners of irrigation development in 1912 that the District would develop a predominantly feed-livestock economy. These planners thought primarily of growth of cereal grain and specialty crops. The District has livestock auction marts and there exist special livestock loading-yard facilities provided by the railway company at Bassano and Brooks. Beef cattle are also shipped by truck from the District. The field study has shown that there are many feed-lots and that most of the livestock grown are finished within the District. Apart from the work of individual farmers and ranchers, an important role of cattle finishing is carried out in the three Hutterite Colonies within the District The number of sheep has declined since 1941, possibly due to the non-availability of pasture and markets. The number of hogs rose during World War II. There occurred shifts away from hogs after the war. There have been sharp changes in the poultry production since 1941. The number of poultry is less in 1966 than in 1941, though 1944, 1963 and 1964 have been peak years. From the field research it has been found that the produce is consumed in the area and the surplus is shipped from Brooks to Calgary. The Canada Census of Agriculture Report for 1966 indicates that approximately three times as many beef cattle and fifty percent more sheep were present in the County of Newell. It was not determined at the time of writing whether these cattle and sheep

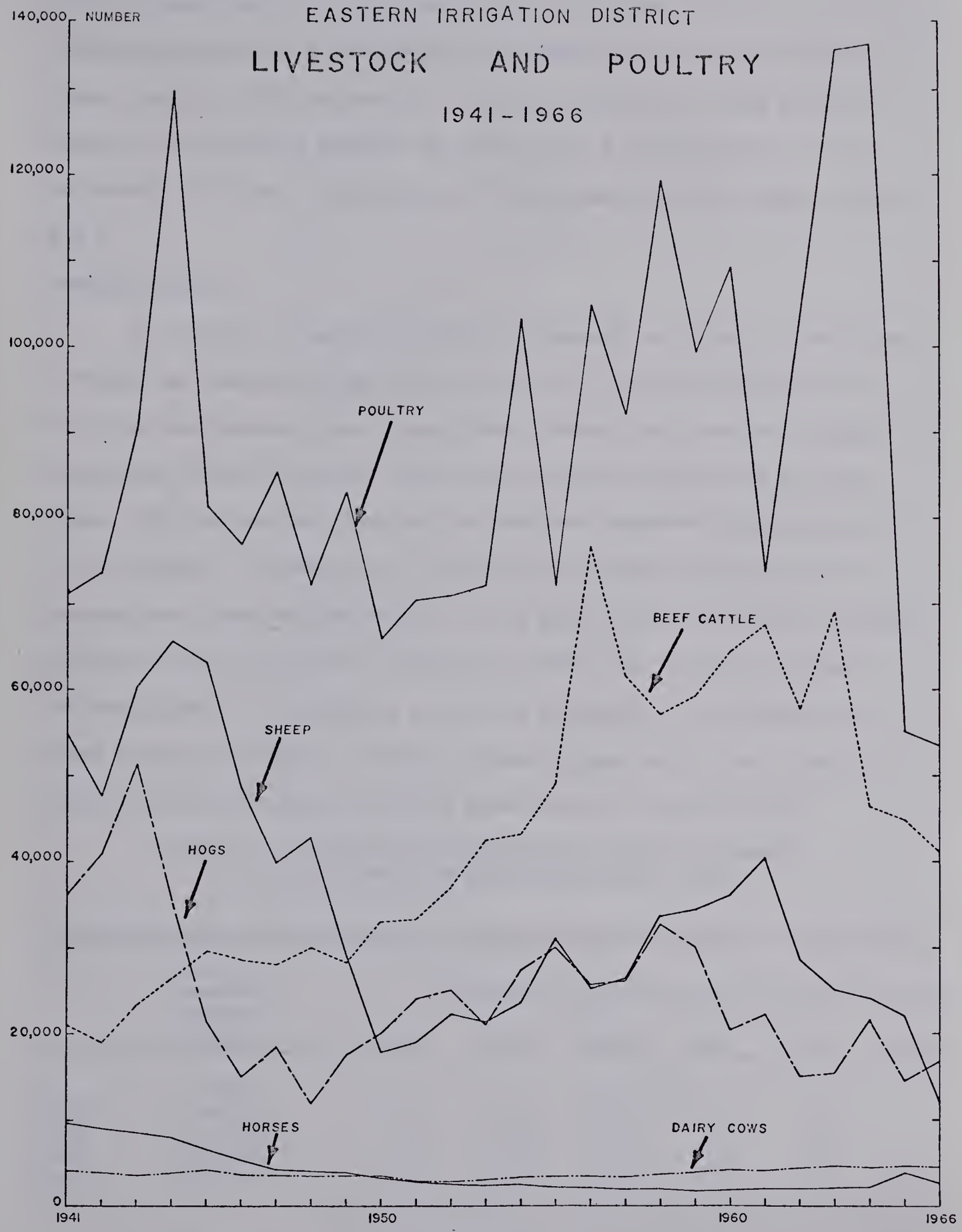

EASTERN IRRIGATION DISTRICT
LIVESTOCK AND POULTRY
1941 - 1966
NUMBER
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1941
1950
1960
1966
POULTRY
BEEF CATTLE
SHEEP
HOGS
HORSES
DAIRY COWS

Fig. 18

were in summer pasture at the time of the Ditch Riders Reports. Further investigation should be undertaken to determine why the Census and Ditch Riders Reports differ so greatly. Figure 19 shows dairy cows which are raised on an irrigated pasture and feed at Mr. A. Young's farm to the south-west of Brooks. Such types of enterprises are quite common in the E.I.D.

SPECIALTY CROPS:

As a result of irrigation and good edaphic and climatic conditions, a variety of specialty crops have been grown in the District since 1914. The crops are potatoes, peas, sugar-beet, beans, corn, carrots, turnips, sun-flower, mustard, alfalfa seeds, and other such vegetables and seed crops. But potatoes and peas are the two most important specialty crops of the District. Acreage under potatoes has increased since 1941 but acreage under peas has decreased. In the post World War II period Alberta has been shipping potatoes to markets in areas from Ontario to Western British Columbia. By assuring regularity of supply it was possible for these markets to expand. The total amount shipped out by rail from 1944 to 1947 from the irrigated areas is shown below. (See Table XIV).

TABLE XIV - AMOUNTS AND DESTINATIONS OF RAIL SHIPMENTS OF POTATOES FROM THE IRRIGATED AREAS, 1944-47

Year	Total Potatoes Marketed by Rail	Proportion and Destination of Rail Shipments					
		B.C.	Alta.	Sask.	Man.	Ont.	U.S.A.
	Cwts.	per cent					
1944	64,745	2.3	56.3	22.2	17.1	2.1	-
1945	117,882	7.3	44.0	43.2	4.7	0.8	-
1946	239,026	2.4	23.0	59.1	13.6	1.9	-
1947	150,757	26.6	23.2	24.8	14.5	9.7	1.2
	Average	9.7	36.3	37.3	12.2	3.6	0.3

Source: C. M. Kline, "Production and Marketing of Potatoes from the Irrigated areas of Alberta," The Economic Annalist, Vol. XIX, Aug. 1949, p. 86.

FIG. 19 - MR. A. YOUNG'S IRRIGATED PASTURE FOR RAISING MILK COWS TO THE SOUTH WEST OF BROOKS

Potato marketing by rail from the irrigated areas shows a variation of from 16 per cent of total production in 1944 to 44 per cent in the peak year 1946. This irregularity was caused by fluctuations in production in the provinces referred to, especially in 1945 and 1946. Until 1947, no well recognized system existed for marketing potatoes from the irrigated areas, and each farmer had to act independently in the disposition of his crop. But later on, central grading, storage and shipping facilities were provided in the irrigated areas for potato marketing. With the completion of the Trans Canada Highway and improvement of Highway 36 (south) good trucking services have developed. There are daily truck services to Medicine Hat and Calgary from Brooks. During the potato season there is a weekly trucking service from Rainier to California. As a result of the finished livestock industry and specialty crops, trucking services are developing and replacing railway transport.

It appears that, in future, markets could be made to absorb more potatoes from the irrigation districts if (a) quality is kept high and, (b) the selling price is kept in line with prices in other areas of potato production.

There are a number of conditions which have restricted potato production in the district. Some of these are within the control of the farmer, others are not. The increase in potato production in other provinces and other districts in Alberta and the relaxation of embargo on potatoes from the U.S.A. have considerably affected, from time to time, the production of potatoes in the E.I.D. At present one of the leading exporters of potatoes to other provinces and the U.S.A. is Tona Ohamo of Rainier.

Another condition which has restricted potato production in the

district is the distance to markets in and outside Alberta. The following table will show the distance of various markets from the E.I.D. with distance calculated from Brooks, Alberta.

TABLE XV - MARKET DISTANCE FROM THE E.I.D.

To	Miles
Vancouver	751
Spokane (U.S.A.)	575
Calgary	109
Edmonton	300
Moose Jaw	324
Regina	366
Saskatoon	538
Brandon	589
Winnipeg	729
SanFrancisco (U.S.A.)	1,510
Los Angeles (U.S.A.)	1,695
Minneapolis (via Winnipeg)	1,185
Toronto	1,963
Fort William	1,141
Ottawa	2,034
Montreal	2,154

Source: Road Map of Alberta, Dept. of Highways, Edmonton, 1968.

During the war years and immediately afterwards, when there were shortages of potatoes in Manitoba, Ontario and West Coast, distance was a less important factor than now. At present Alberta potatoes are competing in the interior of British Columbia and Saskatchewan markets apart from the U.S.A. market. The achievement of a high quality potato has been helping the growers to compete in the open and competitive market.

Another factor which has conditioned the production of potatoes in the district is the fluctuation in prices from year to year depending on demand and supply and the import policies of the Canadian Government. But in spite of all this, irrigation has helped to bring about relative stability in potato production (see Fig. 20).

EASTERN IRRIGATION DISTRICT

POTATOES AND PEAS

1941 - 1966

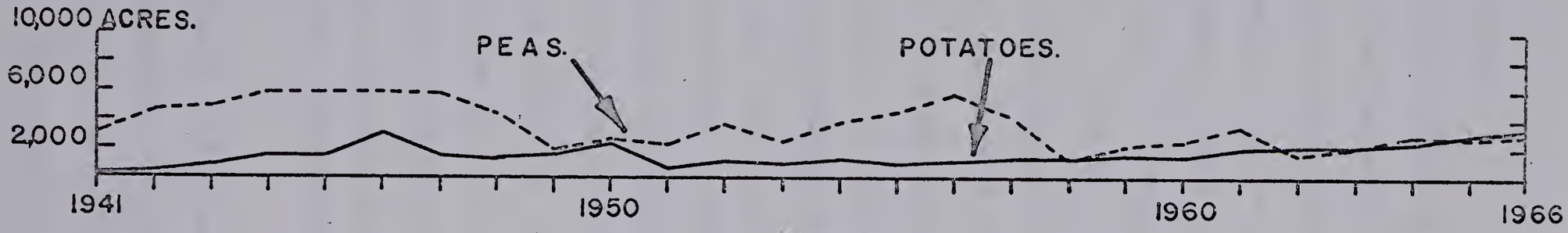


Fig. 20

EASTERN IRRIGATION DISTRICT

SIZE OF IRRIGATED-FARMS

1951 - 1961

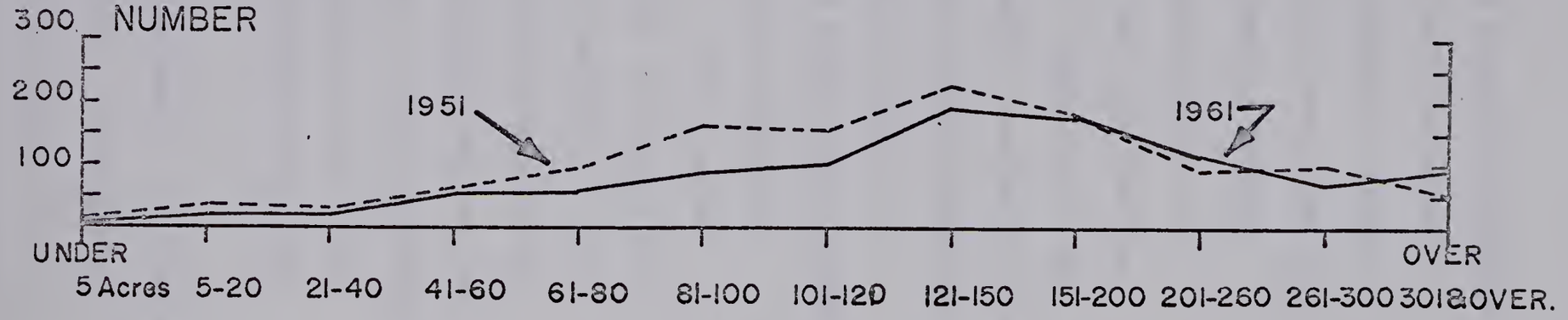


Fig. 21

IRRIGATED PASTURES:

From 1941 to 1962 the acreage under irrigated pasture increased and since then it has been more or less constant. There could be several reasons for this trend in the District, such as the feeding of cattle on harvested forage, intensive use of Community Pastures and rotational use of irrigated pasture. Figure 22 shows a sheep feed-lot east of Scandia. Grazing of sheep is not encouraged on irrigated acreage because of the damage caused to soils and the waste of part of the forage by trampling. The type of damage cuased is evident from the figure. There are a number of such sheep feed-lots in the District, but as a result of decline in sheep marketing such lots are disappearing. Figure 23 shows a cattle pasture in the southern part of the District. It is over-grazed but there is no problem as new cultivation is intended for the coming spring. Such pastures are quite common in the District. Most of the irrigated pastures are replenished with fertilizers and regular irrigation. In the case of Community Pastures which are unimproved (see Fig. 29, p. 106) there is a problem of over-grazing and very judicious planning is required to keep these pastures productive. But with the increase in water supply in the near future, there may not be as much emphasis on irrigated pastures, and irrigated forage crops may be used more widely. There is also a possibility of reclaiming unimproved pastures by providing irrigation by gravity and pumping in loam, fine sand and silt loam areas in the District (see Fig. 28, p. 102).

Because of irrigation, summer fallowing has decreased. The farmers now grow a variety of crops dependong on market demands. But irrigation farming has created new problems of alkali, weeds, water logging and high ground water levels resulting from over-irrigation or seepage from canals

FIG. 22 - A SHEEP FEEDLOT TO THE EAST OF SCANDIA ALONG HIGHWAY 36 (SOUTH)

FIG. 23 - AN IRRIGATED PASTURE USED FOR CATTLE IN THE ROLLING HILLS AREA

and ditches. To reduce these problems planning is required for adequate drainage and other modern techniques. Figure 24 shows the alkaline part of a field west of Rosemary along the road to Gem. Such examples are common in the District. To control this particular problem steps are taken such as growing alkali resistant crop such as sweet clover and deep ploughing previous to seeding. In most cases the ditching is done to avoid problems rather than solve them, that is, to prevent surface soils from becoming excessively alkaline rather than to reclaim them.

PRESENT TRENDS:

A comparison of irrigated farms in 1951 and 1961 (see Fig. 21) shows very interesting trends in the E.I.D. There is a decline in the number of irrigated farms ranging from under 5 to 200 acres in size and also in those between 251 and 300 acres in size. There is a rise in the number of these with 201 to 250 acres and with 301 acres and over under irrigation. In the period from 1951-1961 the average size of irrigated farms decreased. Decrease may be due to greater use of community pastures, a growth in the number of small farms producing specialty crops, high cost of operation, non-availability of seasonal labor and shortage of water to the east of the aqueduct. A comparison of farm sizes (1951 and 1961) indicates that consolidation trends have been most significant in farms having areas of 10 to 397 acres (see Fig. 25). The major reason for this trend is the high cost of operation and the lack of interest in the younger generation in staying and working on the farm. There has been an intermittent increase in acreage under irrigation since 1941 with some fluctuations from 1942 to 1946 but from 1946 to 1967 there has been overall a gradual increase (see Fig. 26).

FIG. 24 - ALKALI DEVELOPMENT IN AN IRRIGATED FIELD - WEST OF ROSEMARY ALONG THE ROAD TO GEM

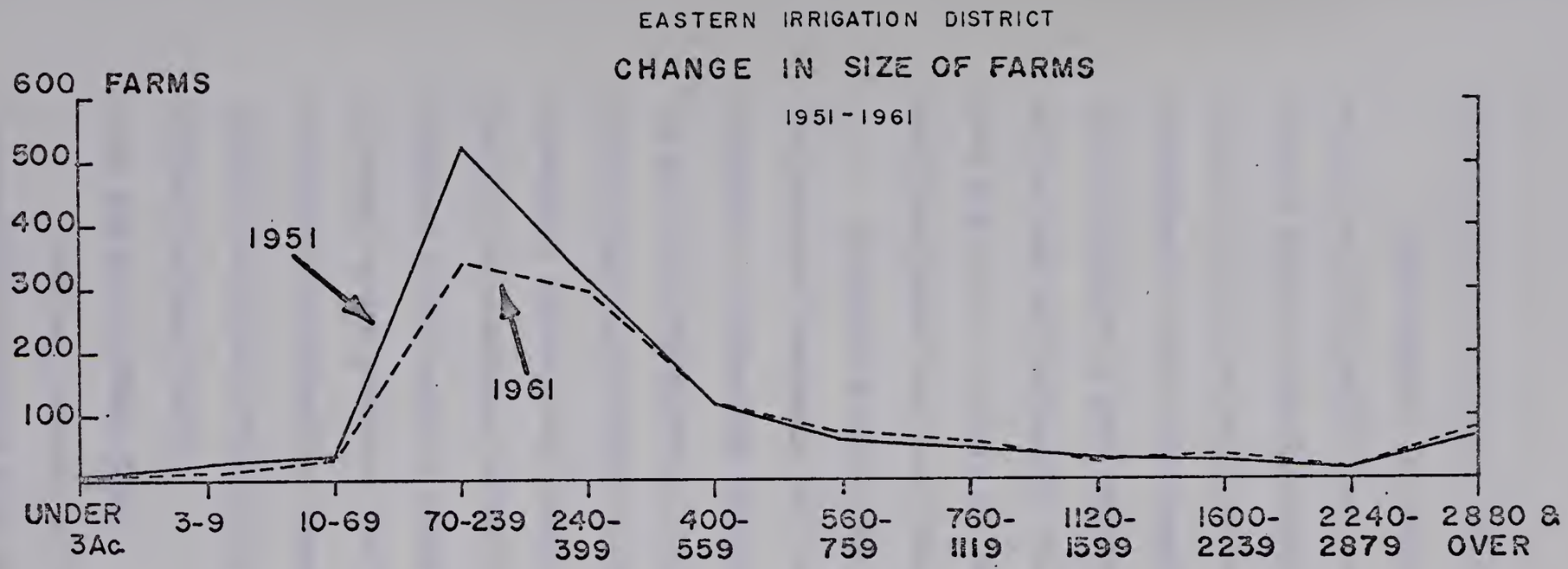

EASTERN IRRIGATION DISTRICT
CHANGE IN SIZE OF FARMS
1951 - 1961
600 FARMS
500
400
300
200
100
1951
1961
UNDER 3Ac.
3-9
10-69
70-239
240-399
400-559
560-759
760-1119
1120-1599
1600-2239
2240-2879
2880 & OVER

Fig. 25

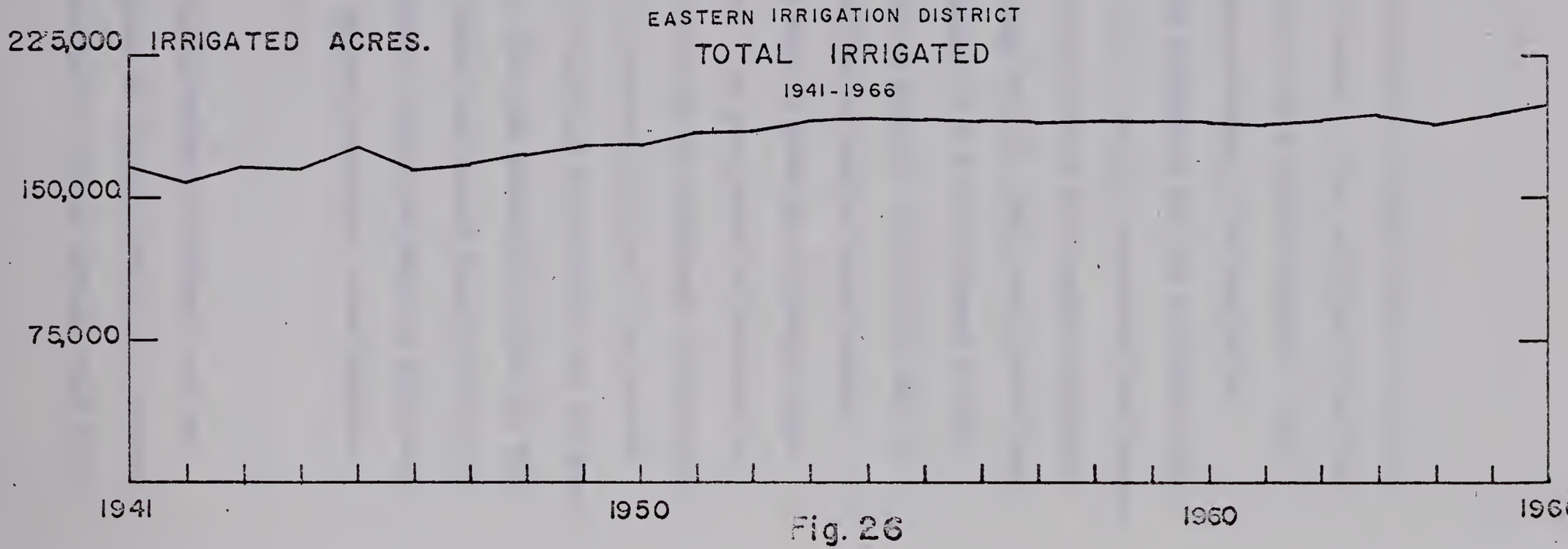

EASTERN IRRIGATION DISTRICT
TOTAL IRRIGATED
1941 - 1966
225,000 IRRIGATED ACRES.
150,000
75,000
1941
1950
1960
1966

Fig. 26

DEVELOPMENT IN PATTERNS OF LAND USE:

This district has undergone a significant change since the introduction of irrigation. The increase of acreage under irrigated crops from 1915 to 1966 has been discussed in this and the previous chapter. There clearly has been an increase in irrigation-farming. The Irrigation Department of the C.P.R. Company planned irrigation for the suitable parts in the District in 1912 (see Fig. 7, p. 52). By 1915 there were few changes in the land use patterns of the type anticipated by the company officials (see Fig. 9, p. 60), but the land use maps of 1962, 1963, and 1966-67 show that development has taken place in general as had been planned in 1912.

Different sources have been used to prepare the land use maps of the District because of the non-availability of similar basic source materials for preparing the sequential maps to show the different stages of land use development in the District. The air photos on the scale of 1":3333 feet and 1":2640 feet taken in 1930 by the Department of Mines and Resources, Ottawa, were checked. Due to non-availability of air photos for all the townships in the District, a land use map for 1930 has not been prepared on the basis of these photos. The 1962 generalized land use map is based on air photos on the scale 1":2640 feet mostly taken in 1962 by the Alberta Department of Lands and Forests. Land use maps for 1963 and 1966-67 are based on the Ditch Riders Reports submitted to the District office for these years.

LAND USE 1962 (GENERALIZED):

This map is based on the air photos referred to above, and the categories are adapted from the ARDA Land Use Classification for Alberta for the Canada Land Inventory (See Appendix I). It is obvious from this

map that various land use patterns have developed since the introduction of irrigation in 1914 (see Fig. 27).

Topographically depressed areas within the upland between the Bow and Red Deer River Valleys have been irrigated. Loams, fine silt loams, and silt loams predominate in these areas. Loams and silt loams in the eastern part of the District are mostly not irrigated because of the roughness and elevation of terrain. The loams, silt loams and fine sandy loams around Lake Newell are not irrigated because of roughness and elevation. Loams north and south of Bassano are unirrigated for mostly topographic reasons. Most of the area east of Bassano, north-east of Rosemary and north of Duchess extending up to the Red Deer River are not irrigated because of roughness of terrain, erosion hazards and unsuitable soils. North-east and north-west of Millicent erosion problems exist and soils are solonetzic. There is an erosion problem in the Matziwin Creek area. To the west of Rosemary, south and south-west of Gem, around Countess and Lathom soils are solonetzic because of the underlying Bearpaw formations. As a result of solonetzic soils and rough terrain fragmentary patterns of irrigated land use have developed (see Twp. 20, 21, 22, Rge. 12, 13, 16, 17, 18 in Fig. 27). The Brooks, Tilley, Rolling Hills, Rainier and Scandia areas have been fewer solonetzic soil problems because the underlying rock formations are less saline (see overlay in Fig. 28). In general the canal system and ditches are laid out to employ the natural drainage patterns and almost all irrigation is gravity oriented.

Edaphically over 75 percent of the District is suitable for irrigation. The major soil patterns have been discussed in Chapter I.

Climatically the District cannot have regular crops in all parts without overcoming moisture deficiencies. The north-west parts of the

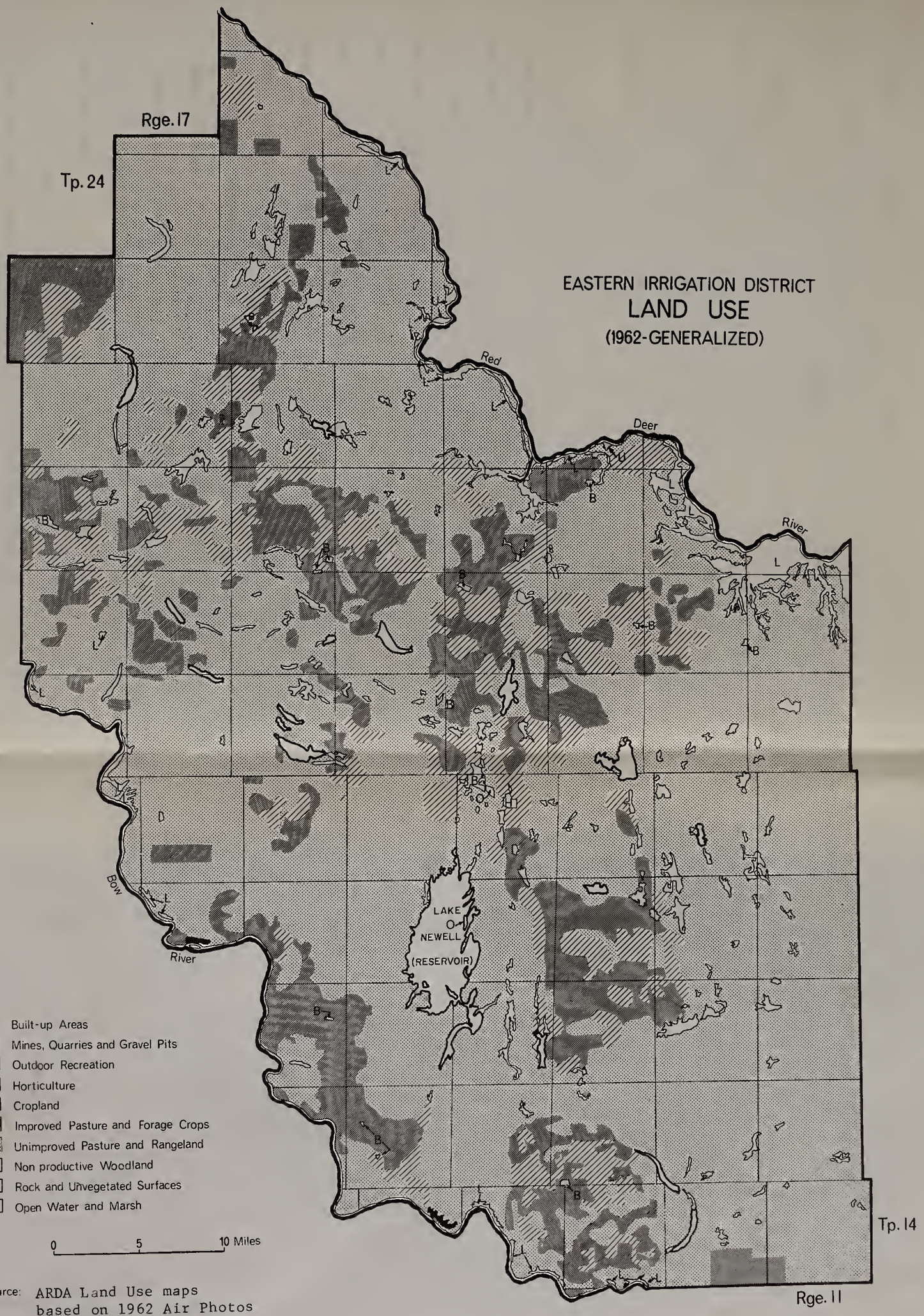

EASTERN IRRIGATION DISTRICT
LAND USE
(1962-GENERALIZED)
Rge. 17
Tp. 24
Red
Deer
River
Bow
River
LAKE
O-
NEWELL
(RESERVOIR)
Tp. 14
Rge. 11
B Built-up Areas
Mines, Quarries and Gravel Pits
O Outdoor Recreation
H Horticulture
Cropland
Improved Pasture and Forage Crops
Unimproved Pasture and Rangeland
U Non productive Woodland
L Rock and Unvegetated Surfaces
Open Water and Marsh
0 5 10 Miles
Source: ARDA Land Use maps
based on 1962 Air Photos

Fig. 27

District (see Fig. 27) have some dry-farming because of the moister and cooler conditions. The most likely areas for sugar beets, some canning crops and other crops that are marginal in Alberta are in the south and east where they would benefit from more heat, longer growing seasons and greater amounts of sunshine than are available in the north and west.

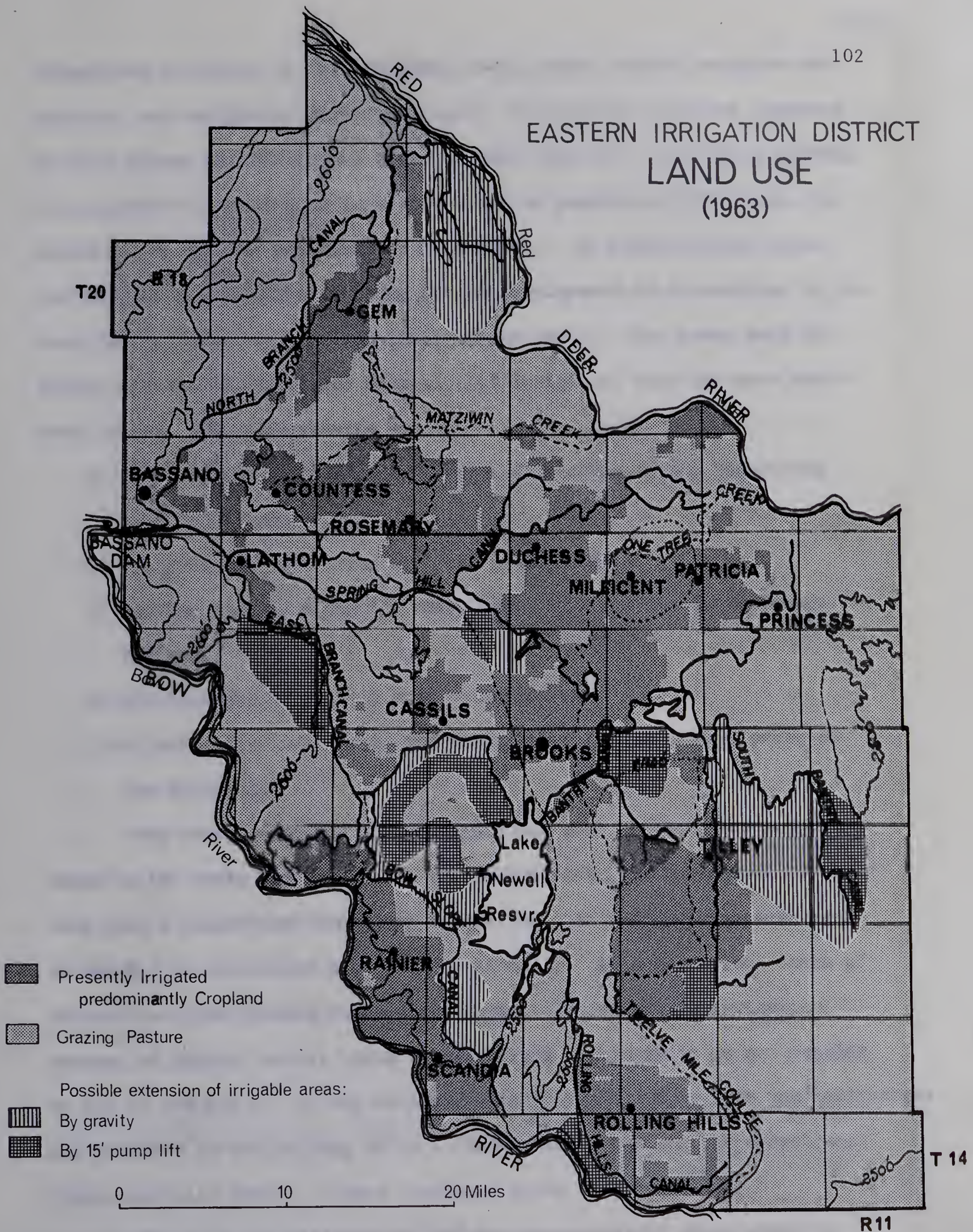
Proximity to the C.P.R. main line has been a factor in irrigation development. The more distinct parts of the District tend to have been developed later e.g. the Rolling Hills area.

The main locational factor for irrigation within the District has been topographic but soil patterns are in part associated with topographic position in this partly bevelled till plain. Climatic, bedrock (e.g. solonetzic soil) and other factors have been lesser considerations. The wide distribution of irrigation within the District separating and being separated by larger areas of dry-land pasture has added to costs but it has also contributed to a better integration of grazing and irrigated land use. This district is accordingly better suited to a beef cattle raising and finishing type of enterprise than irrigation districts in which irrigated lands are in large blocks well separated from dry range areas. The rock and unvegetated area in the Townships 20, 21, Ranges 11, 12 is presently used in part for recreational purposes. The Bow City coal mine is still in operation but other coal mines in the south-east of Rolling Hills, north-east of Duchess and north of Bassano are no longer in operation.

LAND USE 1963:

This map provides a generalized pattern of land use based on section to section data compiled from the Ditch Riders Reports for 1963 (see Fig. 28). The map overlay is used for identifying the location patterns, general elevation, the main canals, villages and towns in the E.I.D. The two main

EASTERN IRRIGATION DISTRICT
LAND USE
(1963)



Presently Irrigated predominantly Cropland

Grazing Pasture

Possible extension of irrigable areas:

By gravity

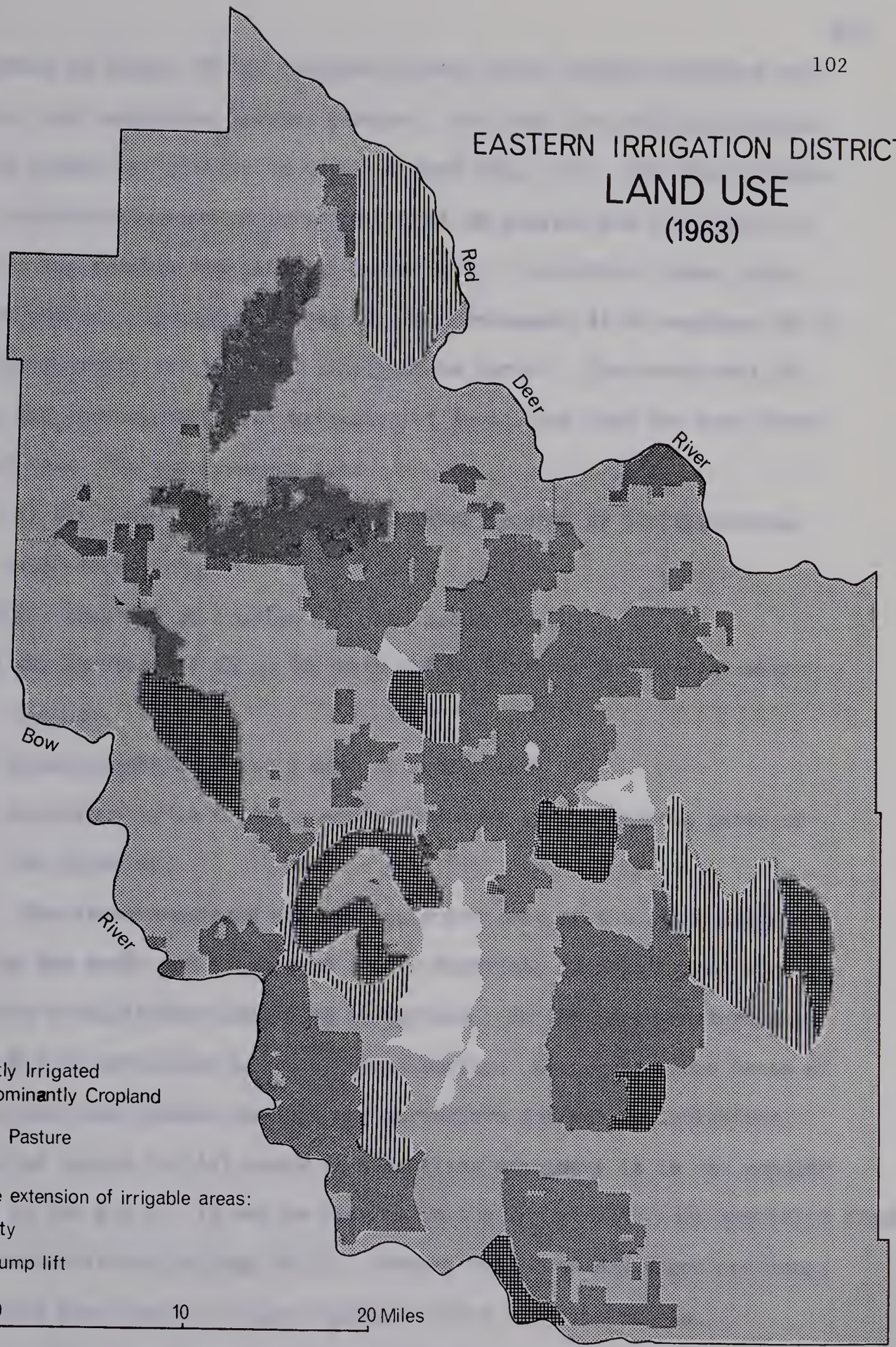
By 15' pump lift

Source: Canada Dept. of Agriculture
P. F. R. A., Engineering Branch.

Fig.28

RED
DEER
RIVER
CREEK
MATZIWIN
CREEK
NORTH
BRANCH
CANAL
GEM
COUNTESS
ROSEMARY
BASSANO
BASSANO DAM
LATHOM
DUCHESS
PATRICIA
MILLICENT
PRINCESS
CASSILS
BROOKS
TILLEY
Lake Newell
RANIER
SCANDIA
ROLLING HILLS
TWELVE MILE COULEE
SOUTH BRANCH CANAL
BOW
CANAL
HILL SPRING
EAST
ONE TREE
T20
T14
R11
R18

EASTERN IRRIGATION DISTRICT
LAND USE
(1963)



Source: Canada Dept. of Agriculture
P. F. R. A., Engineering Branch.

Fig. 28

categories in Figure 28 are irrigated areas, which include cropland and pasture, and unimproved grazing pasture. The land use patterns depicted in this figure are similar to those of 1962 (Fig. 27). The other pattern, i.e. possible extension of irrigated areas by gravity and lift pump, is based on the edaphic and climatic suitability. In 1966-67 these areas had not yet been brought into use but if development is to continue in the near future these are the most likely areas for it. The areas east of Tilley are more suitable for extension of irrigation than the area north-east of Gem. The main reasons are:

a) it has fewer solonetzic soil problems because of the underlying rock formations,

b) the problems of erosion are less pronounced,

c) its location is along the main C.P.R. line and the Trans-Canada Highway,

d) physiographically it is more suitable, and

3) climatically it is drier and warmer than the north-west parts of the District.

The above mentioned reasons apply for most of the other suggested areas in the south and south-east of the District. Technological advances have also a significant impact on irrigation. In the south-eastern parts of the E.I.D. sprinklers are used occasionally. At present Tona Ohama of Rainier and some Scandia farmers use sprinklers for potato irrigation. Because of higher initial costs on sprinkling machinery it is not popular as yet in the E.I.D. It may be popular in the future when more specialty crops are produced in the Rolling Hills - 'banana belt' and Bow Slope sections. This could also result in more expansion above existing canals.

The land use patterns of 1962 are approximately those shown in

tabular form (Table XVI). This table is based on the Ditch Riders Reports for 1963 and shows various categories of irrigated crops.[6] It may be noted that 17,545 acres were not actually irrigated in 1963 as these were in summer fallow. A comparison of different crops and their acreage would be significant to show land use trends in 1963. There were 63,296 acres under all kinds of grain and 62,523 acres under hay and fodder. Most of the forage, irrigated and non-irrigated pastures are used for raising cattle. It has already been shown (Fig 18) that beef cattle have increased in number since 1941. There are 8,391 acres under Oilseeds and 6,704 acres in specialty crops including seeds. It is shown from the above data that the economy of the District is grain and feed-livestock oriented.

LAND USE 1966-67:

This map is also based on the Ditch Riders Reports and the overlay shows the increase in rural population by townships in the E.I.D. from 1901 to 1961 (see Fig. 29). The irrigated areas include cropland and improved pasture. The total irrigated area in 1966-67 was 198,282 acres which is an increase of 5,958 acres over 1963. The general land use patterns have not changed but acreage under irrigation has increased. The "deeded land" decreases every year as the District leases it to the Community Pastures managed and operated by farmer associations.

ANALYSIS OF RURAL POPULATION 1901-61:

The time and extent of irrigation development in the various parts

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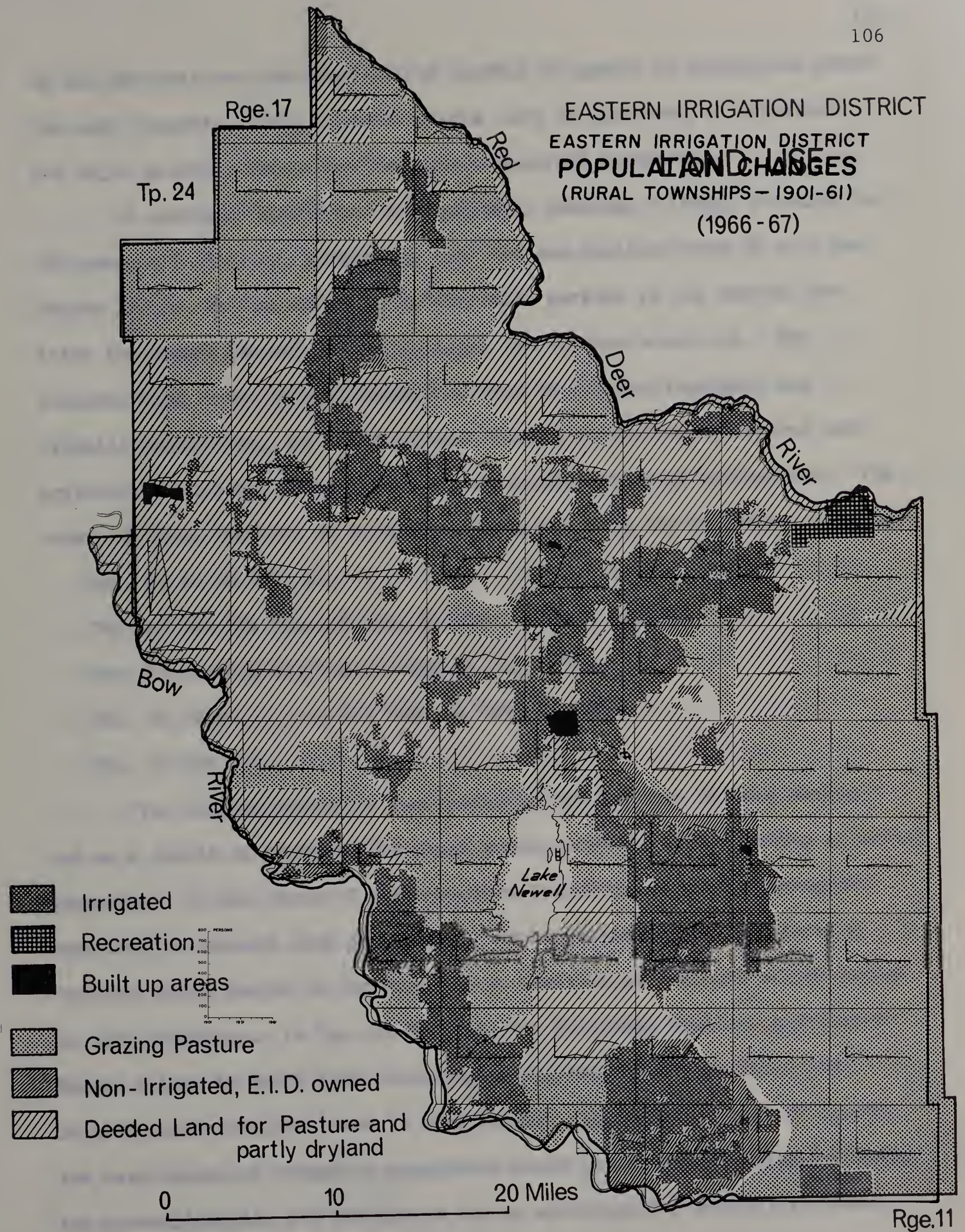
[6] L. C. Allan and K. Elgaard, Irrigation Lands Crop Production Study, All Irrigation Districts, Alberta, 1963, Canada Dept. of Agriculture, Economic Branch, Edmonton, 1963, p. 27.

TABLE XVI - ACREAGE UNDER IRRIGATED CROPS IN THE EASTERN IRRIGATION DISTRICT, 1963

Crops	Acres
Wheat (Durum)	300
Wheat (other spring)	18,148
Wheat (fall)	378
TOTAL WHEAT	18,826
Oats	17,865
Barley	19,564
Mixed Grain	6,834
Rye	207
TOTAL GRAIN	63,296
Alfalfa (and mixes)	56,930
Other Tame Hay	2,423
Greenfeed	2,211
Corn for Ensilage	715
Other Fodder Crops	244
TOTAL HAY AND FODDER	65,523
Flaxseed	7,453
Mustard Seed	804
Other Oilseeds	134
TOTAL OILSEEDS	8,391
Potatoes	2,478
Other Vegetables	193
Field Peas and Beans	2,712
Grass and Legume Seeds	1,321
Tame Pasture	31,048
Other Crops	724
Other Cultivated	405
Summerfallow	17,545
Crop By-products	
TOTAL CULTIVATED	190,636
Native Hay	
Native Pasture	1,217
Other Native	471
TOTAL IRRIGATED	192,324

Source: L. C. Allen, K. Elgaard, Irrigation Lands Crop Production Study, All Irrigation Districts, Alberta, 1963, Canada Dept. of Agriculture, Economic Branch, Edmonton, 1963, p. 27.



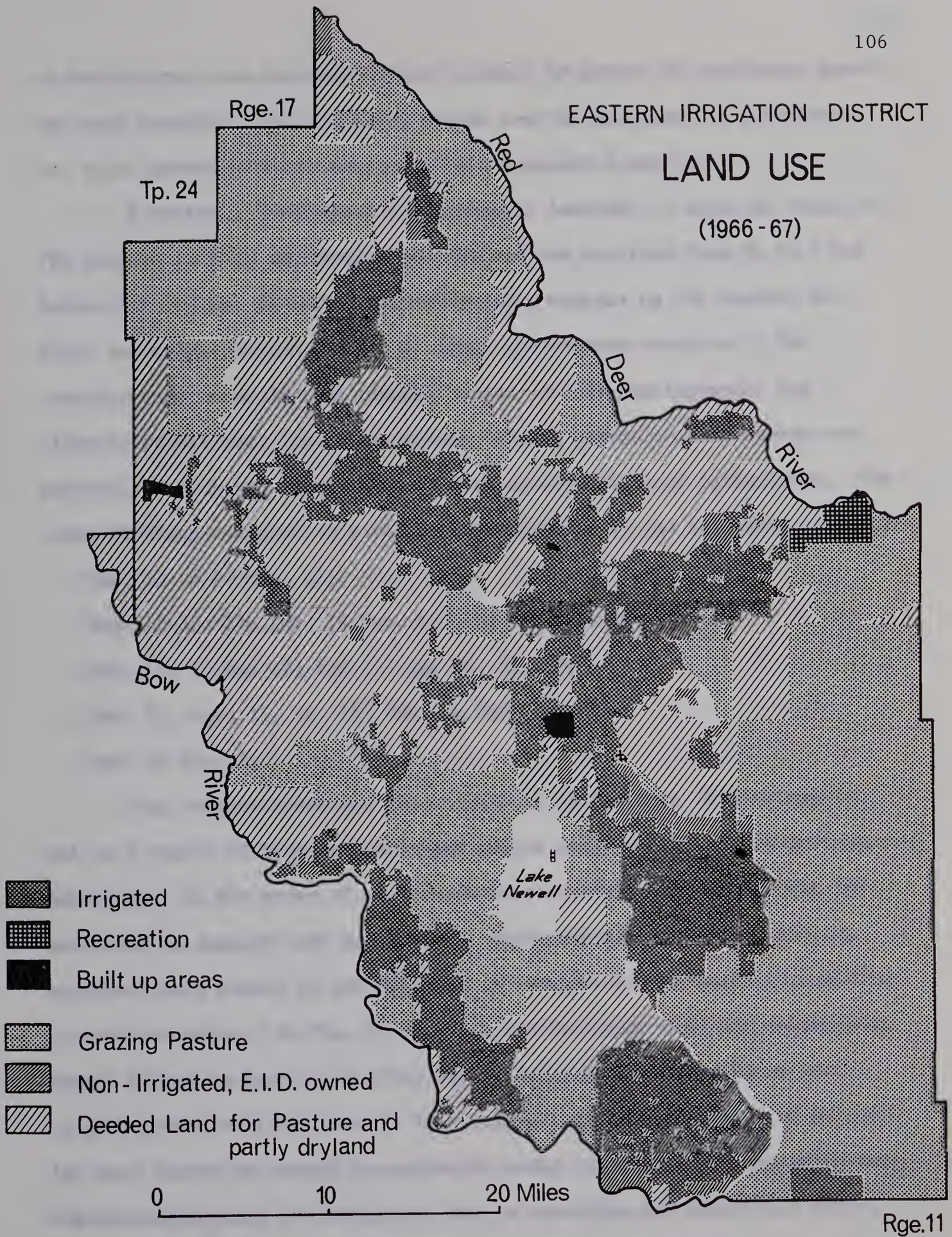
Source: Records of the Eastern Irrigation District

Fig.29

EASTERN IRRIGATION DISTRICT

POPULATION CHANGES

(RURAL TOWNSHIPS – 1901-61)



Source: Records of the Eastern Irrigation District

Fig. 29

of the District are indicated fairly closely by graphs of population growth for each township. Only selected graphs need be discussed to illustrate the major growth patterns and to explain apparent anomalies.

A striking development took place in township 20 range 18 which had 724 persons in 1911, 43 persons in 1921 and has declined from 34 to 6 now. Before 1921 it was populated by construction workers on the Bassano Dam. After the completion of the dam in 1914, the workers moved out. The township came under dryland farming because of its physiographic and climatic conditions. So under dryland farming depopulation occurred not primarily due to bad years but also from mechanization of agriculture. The other striking examples of rural depopulation are in the following townships:

Twp. 14 to 20 Rge. 11;

Twp. 16 Rge 12; Twp. 18 Rge. 17; Twp. 19 Rge. 16, 17;

Twp. 18, 19 Rge 12; Twp. 22 Rge 14, 15, 18;

Twp. 23, Rge. 15, 17, 18; Twp. 24 Rge. 17 and

Twp. 25 Rge. 16.

The eastern townships were populated at the turn of this century but as a result of frequent bad crops people moved to the adjoining irrigated townships. In the cases of north-western townships, dryland farming has been able to support some population. Mechanization of dryland farming required fewer people on the farm and it resulted in decrease of population in such townships. In Twp. 23 Rge. 18, the Hutterian Brethern established Newell Colony in March 1962 after buying dryland from Trapp Farms Ltd. In 1967 seven families lived in this colony. In townships west of Brooks, the main causes of change in population could be failure of dryland farming and non-suitability for irrigation due to elevation and solonetzic soils. Depopulation in the north central townships (south-east of Gem) also

resulted from unsuccessful dryland farming, erosion and development of community pastures.

Generally irrigated townships in the E.I.D. have attracted people from the fringe areas within the District. Some of the dryland farmers and ranchers now live in the irrigated townships on the fringes of these dryland and pasture areas.

The striking effects of irrigation are shown in Twp. 14, 15 Rge. 13, 14 (Rolling Hills) which had 6 persons in 1911, 34 in 1921 and 11 in 1931. After irrigation was introduced in 1934, the population increased to 680 in 1941 and 755 in 1951. The second illustration of the effect of irrigation on population is in Twp. 14, 15 Rge.16 (Rosemary and Gem) where irrigation water was first supplied in 1914. The population increased from none in 1901 to significant number after 1914 (see overlay on Fig. 29). Declines in population are caused by farm consolidation and the centralization of services. Generally there has been an increase in population in all of the irrigated townships with few exceptions where consolidation trends are apparent. There are two Hutterite Colonies in the irrigated townships. The Springside Hutterian Brethren Colony (Parts of Twp. 21, 22 Rge. 13, 14) was established in March 1955 and generally more than half of its acreage is irrigated. The Sunnyside Hutterian Brethren Colony (Parts of Twp. 17, 18 Rge. 17, 18) was established after 1960 and has not much acreage under irrigation (see overlay and Fig. 29). The population in both these colonies contributed to recent increases in the above noted townships.

The recent trends in some of the irrigated townships have included rural depopulation. There could be various reasons for this. One of the most important reasons is that old farmers are retiring and their sons

have no interest in irrigation farming. It has led to consolidation of farming units and depopulation.

A certain decline in the rural population in the E.I.D. can be observed but it is less than in the surrounding areas. The rural, village and town population of the E.I.D. which has coterminus boundaries with the County of Newell No. 4 is shown in Table XVII. There has been significant increase in population of Brooks in comparison to other service centres in the District. This is attributed to many factors based on irrigation farming, secondary industries resulting from irrigation, and developed tertiary services. The Town of Brooks had only 9 persons in 1907 and because of its being a service centre its population increased to 499 in 1921. It had an advantage over Bassano in that it was the central place in the District, a watering station for C.P.R. trains, and headquarters of the Irrigation Block of the C.P.R. Company. Since 1921 the population has continued to increase and many irrigation serving enterprises have been developed. The more significant secondary and tertiary enterprises are natural gas and oil exploiting units,gas stations, farm machinery repairing, potato chip factory, seed processing plants, feed plants, milk hydrating, meat packing, pea storage, cattle auction mart, etc. Recently plans have been made to start a vegetable canning plant for which progress is encouraging.

By comparing the land use maps from 1915 to 1966-67, the following generalizations, regarding the development of patterns, could be made:

1. Generally irrigation has developed as planned but not in the same period of time as anticipated by the planners. Technological changes such as pumping and sprinkling were not considered for the district.

TABLE XVII - POPULATION IN THE E.I.D. SINCE 1901

Sub-Division	1901	1911	1921	1931	1941	1951	1956	1961	1966
County of Newell #4 (Rural)	62	2,410	4,027	4,644	6,195	7,023	5,943	6,038	5,898
Bassano (Town)	-	540	799	615	582	624	753	815	827
Brooks (Town)	-	-	499	708	888	1,648	2,320	2,827	3,354
Duchess (Village)	-	-	116	114	149	258	177	218	233
Rosemary (Do)	-	-	-	-	-	-	158	210	221
Tilley (Do)	-	-	-	-	193	259	240	257	250
Total	62	2,950	5,441	6,081	8,007	9.812	9,591	10,365	10,783

Source: Census of Canada - Dominion Bureau of Statistics, Ottawa, 1901 to 1967

2. A large area has remained as unimproved pasture. The second and third largest areas are devoted to irrigated farming and dryland farming. Irrigated areas mostly produce grain and forage for livestock. Dryland crop areas are mostly in the north-west of the District and are marginally successful thanks to slightly more favourable climatic conditions. Most of the unirrigated areas in the District are higher lying and have rough terrain.
3. Generally the population has increased in townships under irrigation. Dryland farming and pasture areas have experienced depopulation due to frequent crop failures and increases in the area a family can and must farm to make a living.
4. The town of Brooks has had significant growth. This has been generated by many factors such as the development of secondary

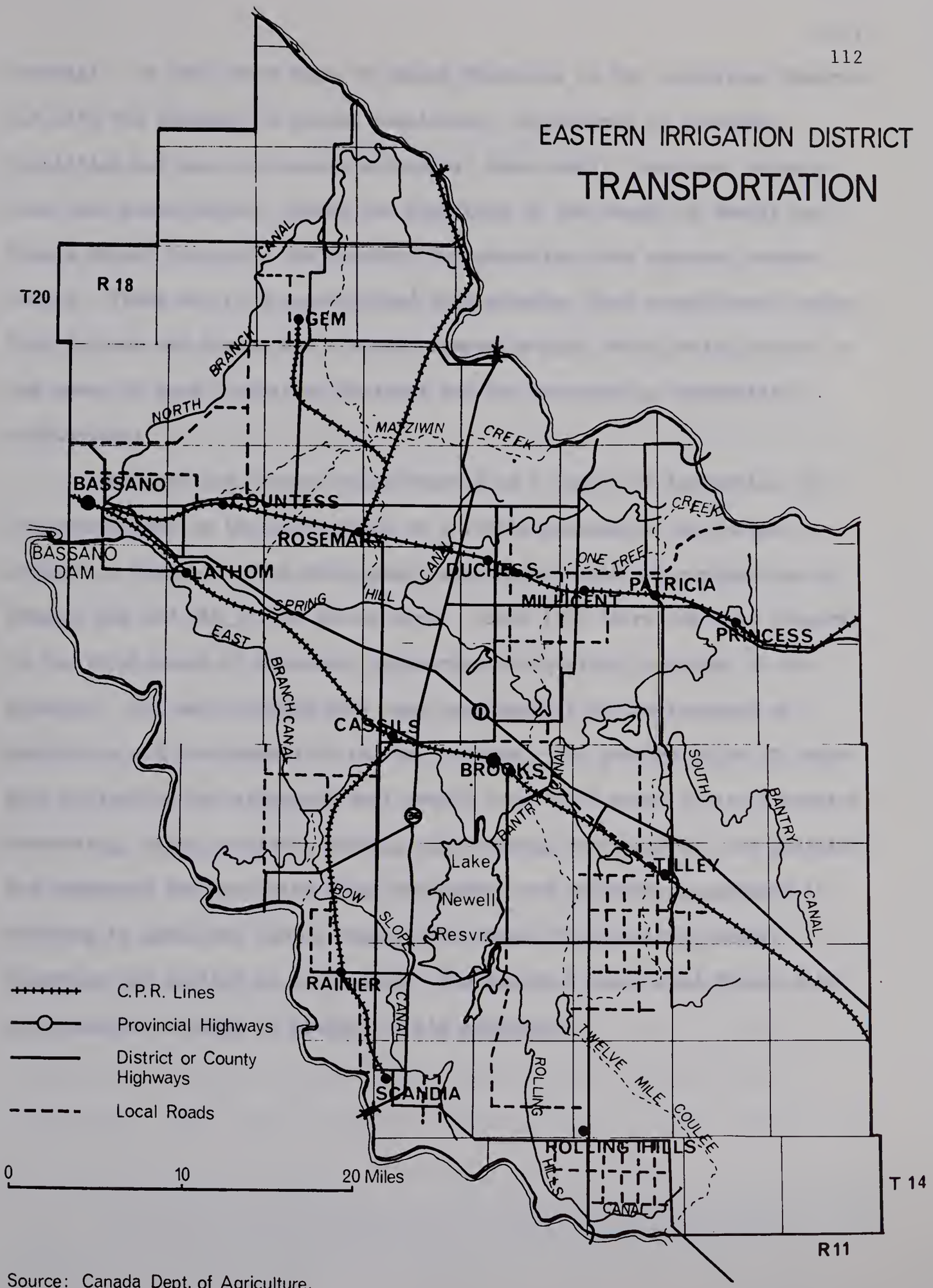
farm oriented industries, highways, oil and gas exploitation, recreation and hunting facilities and the concentration of administration, municipal and education services.

5. Finally rural depopulation in irrigated areas has been significantly less than in non-irrigated nearby areas, e.g. north of the Red Deer River.

Since the District was transferred to the farmer management in 1935, there has been overall development in transport. New dirt roads were constructed and older roads were improved. The Trans-Canada Highway has been improved and straightened in the last fifteen years. The old Trans-Canada Highway serves the area as well but it is looked after by the County of Newell. Highway 36 which divides the District and connects it with Hanna in the north and Taber in the south is paved from Brooks to Taber and is very busy road. The road between Hanna and Brooks is an all-weather road. Within the coming few years this portion of Highway 36, north from Brooks, will be paved by the Alberta Department of Highways. The Trans-Canada Highway and Highway No. 36 (south) are under the Alberta Government management and all other roads of the District are the responsibility of the County of Newell No. 4 (see Fig. 30). The new Trans-Canada Highway which crosses the District from south-east to the north-west has contributed to the increase in traffic but also has affected the economy of the District. Now it takes much less time for the District residents to go to Medicine Hat, Lethbridge or Calgary which are 67, 90 and 105 miles respectively from Brooks. It is felt that these two highways are affecting the district economy greatly with the increase of motels, gas stations and other tertiary services.

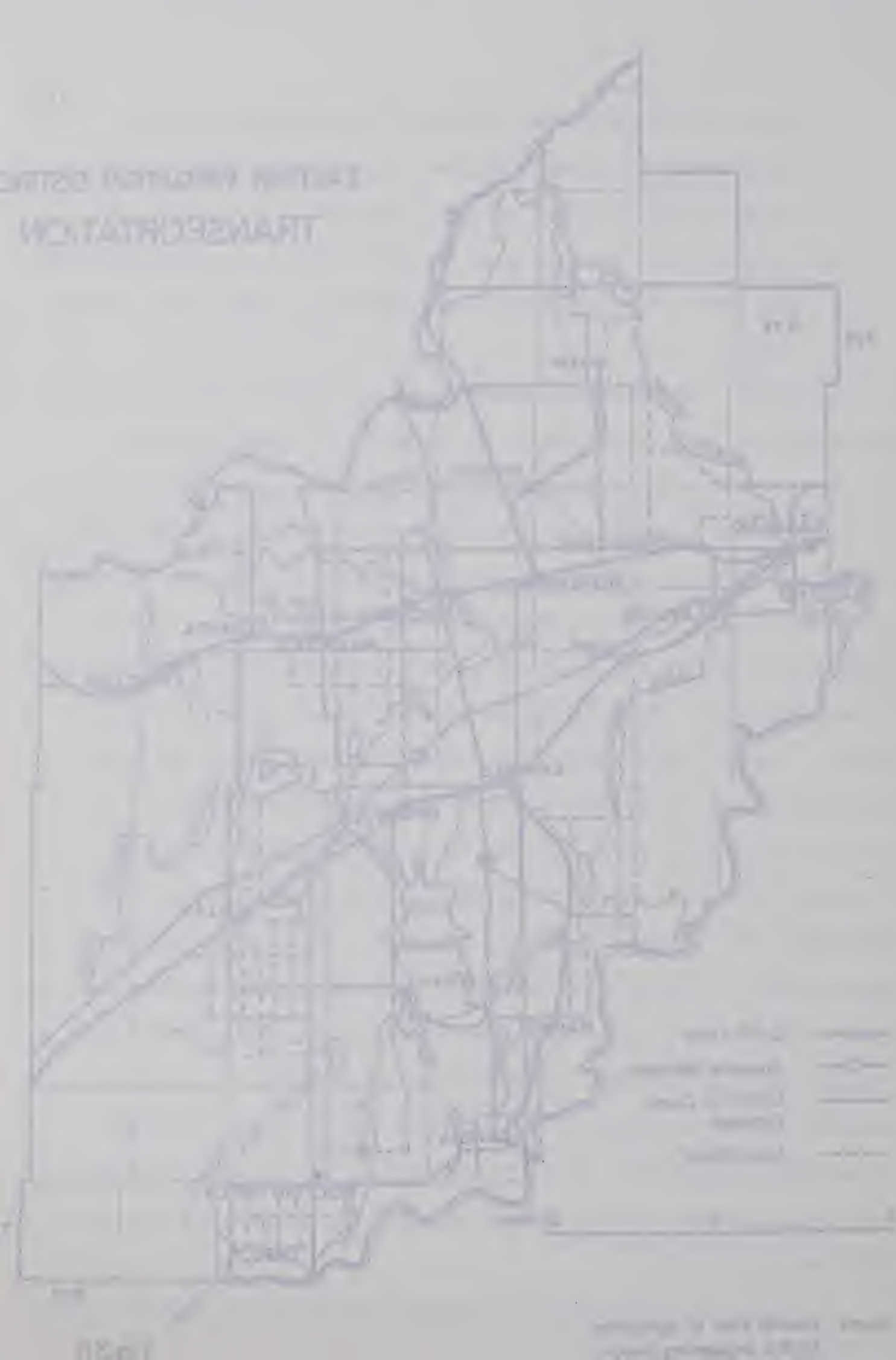
The C.P.R. Company started one-room schools for the settlers in the

EASTERN IRRIGATION DISTRICT
TRANSPORTATION



Source: Canada Dept. of Agriculture, P.F.R.A., Engineering Branch.

Fig.30



District. In 1921 there were 21 school districts in the Irrigation District but with the increase in school population, improvement in transport facilities and more government subsidies, these small 'one-room' schools have been consolidated. Since the formation of the County of Newell and Brooks School District, the services for education have improved tremendously. There are five consolidated high schools, four consolidated Junior High Schools and Brooks has a modern Composite High School which caters to the needs of this irrigation District and the surrounding communities.

CONCLUSIONS:

Land use has changed significantly as a result of irrigation. It has contributed to the development of a viable economy in the Eastern Irrigation District. The development was boosted with the exploration of natural gas and oil in the Brooks area. Since 1935 there has been progress in the development of secondary industries and tertiary services in the District. All such factors have been instrumental in the increase of population and development of service centres. The greater value of crops with irrigation has attracted many people from other areas to start canning, processing, dairy, poultry, packing and trucking enterprises. The district has developed its specialty crops and associated secondary industries in addition to grain and forage crops. The demand for specialty crops, livestock and poultry is increasing. The District has a good future with a reasonable standard of living for its population.

CHAPTER V

SUMMARY AND CONCLUSIONS

The Eastern Irrigation District is one of the largest and oldest irrigation developments in Alberta. It forms a part of "Palliser's Triangle" which was considered precariously suitable for dry-land farming. Ranching was mainly practiced here. With the idea of establishing permanent and more productive settlement, the C.P.R. Company planned irrigation schemes in the early decades of this century. It was believed that Irrigation-agriculture would supply increased amounts of freight traffic for the company in addition to providing greatly enhanced land value for the C.P.R. land grants and a profitable return on investment in irrigation facilities.

The Canadian Pacific Railway Company invested $13,000,000 in the development of irrigation in the District. As a result of which it was able to sell more land to the new settlers at various terms and generate increased freight revenues.

The Company transferred all assets of the Eastern Irrigation Block and a payment of $400,000 to a Provincially incorporated farmer owned Irrigation District in 1935. The Company records had indicated that this settlement grant of $400,000 was approximately equal to the annual operating deficit of the Block in the previous six years. The E.I.D. has since operated without loss, though at the expense of some deterioration of structures.[1] As a result of greater productivity and improved markets, the

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[1] P.F.R.A., The Annual Cost of the Eastern Irrigation District, Canada Dept. of Agriculture, Engineering Branch, Calgary, May, 1965, p. 40.

E.I.D. has developed an overall stable economy, and most settlers own their lands and lead a good life.

The major purpose of this study was to trace land use changes resulting from the development of the Eastern Irrigation District. In the course of this survey, a number of questions concerning the desirability of investment in irrigation appeared to require answer. Hav the individual farmers in this irrigation area obtained as great a return for their labours and investments than farmers engaged in dry farming, mixed farming or ranching in the neighboring areas? Various conclusions have been given in answer to these questions, for example those of Rogers, Manning and Grubb,[2] but it can be suggested that although returns on project and farm investments have not been as great as had been anticipated, a flourishing, viable economy has been developed.

The Eastern Irrigation District is expanding its farming operations, has suffered little rural depopulation, has growing secondary industries and service centres, is contributing an increasing revenue freight traffic in an otherwise low productivity area on the main line of the C.P.R., and is playing an active, contributing role in the Canadian economy. The growth potential in the District is large and varied in nature. It might well be said that land use changes associated with irrigation project development in the Eastern Irrigation District have been and are a tribute to those who are continuing to make the District a success.

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[2]W. B. Rogers, T. W. Manning and H. W. Grubb, The Economic Benefits and Costs of Irrigation in the Eastern Irrigation District of Alberta, Alberta Irrigation Studies, Vol. V, Edmonton, 1966, pp. iii-iv.

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APPENDIX I

A.R.D.A. - ALBERTA

Present Land Use Classification for Canadian Land Inventory

Mapping Symbol

1. Urban. Land used for urban and associated non-agricultural purposes.

B — a. Built-up areas. Land occupied by the built-up portions of cities, towns and villages, as well as isolated units away from settlements, such as manufacturing plants (e.g. gas processing), rail yards and military camps. Open fields and parks within built up areas are included.

E — b. Mines, quarries and gravel pits. Land used now or in the past for the extraction of earth minerals.

O — c. Outdoor Recreation. Land used for private or public outdoor recreational purposes. Summer cottages and associated beach areas, parks and golf courses are included.

H — 2. Horticulture. Land used for the intensive production of vegetables and small fruits. Market gardens, nurseries, flower-growing areas and sod farms are included.

G — 3. Orchards and Vineyards. Land used for the production of tree fruits and grapes.

A — 4. Cropland. Land used primarily for cash crops, usually in rotation but including both cash and feed grains. Oilseeds, sugar geets, potatoes, field vegetables, associated fallow and land in the process of being cleared for cultivation are included.

P — 5. Improved Pasture and Forage Crops. Land used primarily for the production of improved pasture, hay and other forage crops. Cultivation and planting have occurred in a recent year.

K — 6. Unimproved Pasture and Range Land. Open grassland and scrub grassland primarily, whether used for this purpose or not (e.g. remote meadows).

Open grassland includes grasses, sedges, herbaceous plants and scttered shrubs to four feet in height. Abandoned farms and intermittently wet hay land (sloughs are included).

Scrub grassland includes more widespread shrubs and small trees (e.g. to 20 feet in height) which may cover up to 30% of the area.

Open woodland has a crown cover of less than 30% and trees are less than 20 feet in height. It is classified as pasture and

Mapping Symbol	
	range if it is on or contiguous with occupied farmland or if evidence of grazing activity is present.
	7. Woodland. Land covered with tree or scrub growth.
T	a. Productive Woodland. Land bearing forest with over 30% crown cover and 20 feet in height plus artificially restocked and planted areas regardless of age.
U	b. Non-Productive Woodland. Land with sparse or scrub growth (i.e. less than 30% crown cover and 20 feet in height) that shows no evidence of grazing (see 6). Largely recently cut-over or burnt-over land.
M	8. Swamp, Marsh and Bog. Open wetlands except for those showing evidence of haying activity in the drier years.
	9. Unproductive Land. Land that is biologically unproductive in its present state.
S	a. Sandflats, dunes, and beaches. Exposed sand surfaces predominate.
L	b. Rock and other unvegetated surfaces. Rock barrens, badlands, eroded river banks, etc.
X	10. Water Surfaces. Excluding temporarily flooded hay meadows, etc.